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To the Membership

IT is the privilege of all members of the American Congress on Surveying and Mapping to participate actively in its Technical Divisions. This activity is a strong force in advancing the sciences of surveying and mapping and professional standing in all branches. Member interest in the various Technical Divisions will further the aims and objectives of the Congress. All members can support activity of the Technical Divisions by expressions of interest in them. As provided in the By-Laws, Section III, item 5, operational budgets may be estimated by Division officers in proportion to membership interest expressed in the Technical Divisions.

A canvass of the membership interest in Technical Divisions is important at this time. A stamped return card is provided in this issue of the Journal for that purpose. Please fill it out promptly for quick return. Indicate your interest in the organized Technical Divisions listed on the card, or your preferred field of interest, by order of choice. Mark 1, 2, 3, etc., (first choice, second, etc.) in the boxes provided on the card. Don't wait, do it now. Fill out your card and drop it in the mail promptly.

—EXECUTIVE SECRETARY

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Opinions or assertions expressed in articles in this Journal do not necessarily represent the official views of the Congress.

The Eighth Annual Meeting

The broad scope of Congress activities was emphasized by the many excellent papers read by noted speakers at the Eighth Annual Meeting of the American Congress on Surveying and Mapping, held in Washington, D. C., on June 21–23, 1948, at the Hotel Statler. The Meeting, attended by about 400 members and guests, was officially opened by President Marshall S. Wright.

Frank Pace, Jr., Assistant Director, Bureau of the Budget, after being introduced by President Wright, extended a welcome on behalf of official Washington. For the benefit of the members and guests from the Latin American Republics Dr. Simonpietri translated into Spanish the remarks of Mr. Pace. Dr. Simonpietri also welcomed the Congress on behalf of the Commission on Cartography of the Pan American Institute of Geography and History. Both addresses follow this report.

An address by Francis A. Pitkin, Executive Director, State Planning Board of Pennsylvania, on "Maps and Air Photographs—Necessary Tools for State Planning and Development," provided the technical keynote of the meeting.

During the afternoon of the same day special meetings of the technical divisions were held. Brief summaries of these sessions are published elsewhere in this issue, while the detailed minutes of each will be sent to all members in the form of special reports. The active technical divisions are Control Surveys, Property Surveys, Surveying Instruments, and Cartography.

GENERAL SESSIONS

The morning of the second day began with a panel discussion on "Developments and Trends in Surveying Instruments." Talbert Abrams, Abrams Aerial Survey Corporation, Lansing, Mich., who presided, was ably assisted by F. L. Johnson, Sperry-Sun Well Surveying Co., Philadelphia, Pa.; Harold R. Larsen, W. & L. E. Gurley, Troy, N. Y.; and Carl W. Keuffel, Keuffel & Esser Co., Hoboken, N. J. The members exhibited a keen interest in the research and plans for the various devices which, as a result of recent developments in materials and techniques, American instrument makers have been able to design.

The morning session was concluded with a paper on "Recent Developments in Control for Mapping," by R. M. Wilson of the U. S. Geological Survey.

On Tuesday afternoon "Ethics and Professional Aspects of the Surveyor" was the subject of a panel discussion conducted under the direction of Dr. N. W. Dougherty, Dean of Engineering, University of Tennessee. Participants in the proceedings were S. A. Bauer, Cleveland, Ohio; John P. Goggin, Clare, Mich.; Dr. F. H. Kellogg, University of Mississippi; Prof. Frank C. Mirgain, Rutgers University; Raymond L. Moore, Chattanooga, Tenn.; and Paul H. Robbins of the National Society of Professional Engineers.

"Cadastral Surveys" were ably discussed by Earl G. Harrington of the Bureau of Land Management on Wednesday morning, followed by a paper on the "Relationship Between the Surveyor and the Title Company," by James T. Knight of the Lawyers Title Insurance Corporation, Richmond, Va. Commander Elliott B. Roberts of the Coast and Geodetic Survey also gave an interesting account of secular change in the earth's magnetism.

The final general session on Wednesday afternoon, with Helmuth Bay of Rand McNally & Co., presiding, was devoted to a number of interesting papers

on various subjects. Dr. Burton W. Adkinson, of the Library of Congress, described the map program of that institution. The subject of "Speleology" (Subterranean surveys) was ably presented by William E. Davies of the Army Map Service. "Highway Engineering in Maryland," discussed by William F. Childs, Jr., of the Maryland State Roads Commission, gave the listeners a detailed insight of an ambitious state highway program. Prof. Ralph P. Black, Georgia School of Technology, explained the "Aims and Activities of the Georgia Association of Registered Land Surveyors," a recently organized association and the first to affiliate with the Congress as an Institutional Member. Harry A. Marmer of the Coast and Geodetic Survey discussed the "Datum of Mean Sea Level," while the activities of the Hydrographic Office of the Navy were depicted by Guillermo Medina of that institution. The concluding paper, presented by Dr. John A. O'Keefe of the U. S. Army Map Service, was a description of the "1948 Solar Eclipse Expedition to Rebun-Jima." Excellent colored slides taken by Dr. O'Keefe illustrated his discussion.

The panel discussions will be printed as separates and will be sent to all members.

BUSINESS SESSION

The annual business meeting of the Congress was held on the morning of June 23 and was presided over by President Wright.

The first item on the agenda was the presentation of awards to the winners of the 1947 special prize contest on the two best papers submitted for publication in SURVEYING AND MAPPING. First prize of $100 went to Prof. Fred Morris of the Virginia Polytechnic Institute for his paper, "Time for Action." The $50 second prize winner was Lt. Harold J. Seaborg of the Coast and Geodetic Survey for his article, "Astronomic Azimuths in Alaska and Canada."

A special award of $100 was made to Walter S. Dix, Secretary of the Congress, by the Board of Directors, as a "slight token of our everlasting appreciation" for his untiring and unselfish devotion to the welfare of the Congress.

Then followed reports by Walter S. Dix, Secretary, and Richard T. Evans, Treasurer. An encouraging report on the status of SURVEYING AND MAPPING was given by the Editor-in-Chief, A. L. Shalowitz. (These reports are published elsewhere in this issue.)

Technical division and committee reports were given by Capt. H. W. Hemple, Chairman, Control Surveys Division; S. A. Bauer, Chairman, Property Surveys Division; W. C. Crump, Chairman, Cartography Division; Prof. George H. Harding, Resolutions Committee; and Fred Williams of the Annual Program Procedure Committee, whose recently appointed group offered some excellent and constructive suggestions for the conduct of future annual meetings. These suggestions have been turned over to the Annual Meeting Committee.

A. C. Kalbfleisch, Chairman of Tellers, then presented his report on the results of the annual election. Marshall S. Wright was elected President, and Prof. George H. Harding, Vice President. The elected Directors were Capt. K. T. Adams, U. S. Coast and Geodetic Survey; Dr. Burton W. Adkinson, Map Division, Library of Congress; S. A. Bauer, Surveyor and Engineer, Cleveland, Ohio; Prof. John S. Dodds, Ames, Iowa; Gerald FitzGerald, U. S. Geological Survey; Carl W. Keuffel, Keuffel & Esser, Hoboken, N. J.; Gordon B. Little-

page, U. S. Coast and Geodetic Survey; O. M. Miller, American Geographical Society, New York; Frederick H. Peters, Surveying and Mapping Bureau, Ottawa, Canada; Rear Admiral Paul A. Smith, I.C.A.O., Montreal, Canada; and Robert L. Wing, Sacramento, Calif. Capt. Frank S. Borden, the last past President, automatically became a Director under the new constitution.

A short meeting of the Board of Direction was held after the business session adjourned, at which time the appointments of the Executive Secretary, the Treasurer, and the Editor-in-Chief were approved.

EVENING DINNER

The annual dinner was held on Tuesday evening, June 22, in the Congressional Room. It was preceded by cocktails served in the South American Room.

Murray Y. Poling, as master of ceremonies, was outstanding in his role, seemingly not fatigued by the heavy responsibility of Chairman of Arrangements for the Eighth Annual Meeting. He kept the guests in a jovial and happy frame of mind throughout the evening with his quips, remarks, and introductions. During the dinner there was instrumental music and afterwards vocal and novelty entertainment.

INSTRUMENT EXHIBIT

The exhibit of surveying instruments was again one of the outstanding features of the Meeting, and great interest was shown by members and guests in the many new and improved devices on display. The sponsors included Theodore Alteneder & Sons, Inc.; Bausch & Lomb Optical Co.; C. L. Berger & Sons; Charles Bruning Co.; Brunson Instrument Co.; W. & L. E. Gurley; Sperry-Sun Well Surveying Co.; Keuffel & Esser Co.; Submarine Signal Company; Wallace & Tiernan Products, Inc.; and Henry Wild Surveying Instruments Supply Company of America, Inc.

ALBERT STANLEY
HELMUTH BAY

Remember

The Ninth Annual Meeting

JUNE 8, 9, 10, 1949

Hotel Statler, Washington, D. C.

Address of Welcome

By FRANK PACE, JR.

ASSISTANT DIRECTOR, U. S. BUREAU OF THE BUDGET

IT IS A PLEASURE for me to welcome you here today on behalf of official Washington. It is a pleasure in two regards, one, because of the importance of the work that you have come here to perform and, two, because of my personal interest in the work that you are doing, primarily because of the thoroughness with which I have been familiarized with your work by Mr. Randall and his work in our Bureau of the Budget.

I am undertaking a rather difficult experiment with you gentlemen. I am going to speak completely extemporaneously. I am reminded of an affair in the State of Georgia where a large crowd had gathered one day to hear a substantial number of speakers. Each of them came loaded with prepared addresses and charts and the necessary accompaniments to provide them with the necessary speech-making paraphernalia. However, as the day wore on and as the speeches became more routine, the crowd began to diminish until the last speaker arose and he found that he only had one left in his audience. However, the one man stayed throughout his speech and evidenced great interest. As he finished, the audience not being large, he stepped down and said, "I want to thank you very kindly not only for your continuing interest, but for remaining to hear me speak throughout my speech."

The reply was, "Don't worry about that, my good man. I am the last speaker."

Rather than undertake that possibility, I am going to try to speak to you more intimately and possibly less fluently. I am going to speak to you in a serious vein rather than in a light vein, because of the fact that this group that has come here to Washington represents substantially and completely the public service point of view in this Nation. This is a period in our Nation when the attitude and approach toward public service is extremely important and, consequently, if I may, I would like to press upon you some of the problems that are faced from the point of view of the public servant today. These are, indeed, perilous times. After the last war, from which we emerged victorious, the people of the United States felt that the time had come to relax and return to a normal form of living, but they found that this was not quite as easy as it had originally seemed. True, individual incomes had sprung to a proportion that had never been before reached in the history of this country. Unemployment was at a minimum; the number of persons actually employed is greater today than ever before in the history of this country.

The items that were difficult to acquire during the war began to come into somewhat easy access. Vacations could be planned on gas that was not rationed, tires that were not synthetic. And maybe, if you had the money, you could get a new model automobile.

Those, you would say, are the ingredients of normalcy. Yet every man and

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woman who lives in this country recognizes that such is not the case and there is a specific reason why this country, the normal tendency of which is to relax and take life somewhat with a laugh, has found that we are living in a period of tension.

I think probably the first reason is that we have been cast in a relatively unfamiliar role of world leadership. There was a period during the early growth of this country when troubles with the responsibilities of internal development made us look solely at our own problems and live in a relatively pleasant isolationism. There is sometimes a tendency on the part of American people to say, "There is a big enough problem to meet in our own country. Let other countries think about their problems. Let's meet ours first."

But those of us (and I assume most of you have had that opportunity) who have had the opportunity to travel abroad realize that that opportunity of meeting our own problems solely cannot be. If you have traveled abroad or if you have been abroad in a representative official capacity, as I was fortunate enough to have been as Chief of the United States Delegation to the Universal Postal Congress in the spring of last year in Paris, you have recognized that leadership in one capacity or another is ours. You see it in the faces of the people of Europe who are looking at you. You see it in their attitude of approach toward the representatives of the United States of America.

So I think we can accept it as a fact that we must undertake our responsibility to the world at this time. I think because there are areas in the world today where the hope of return to the type of living that they once knew is dim, the emphasis on that role of leadership and responsibility is even greater.

Domestically, too, we have our problems, the great problems of facing destruction by fire and by floods, the latter most recently evidenced by what has happened in the Pacific Northwest. That can be and is being met by the instruments of Government. But we face a problem that presents great difficulties to this Nation—the problem of the high cost of living. Our people who are employed and drawing higher incomes than they have in the past find their dollars going not so far. The housewife planning her weekly budget finds that it is growing at an alarming rate. You who have planned to buy a new home find that the cost of the new home is far greater than you had anticipated. Those are problems of a domestic nature that have come upon this country and must be met. The costs of Government have risen just as the costs of individuals have risen. Government must spend dollars and those dollars do not go as far as they normally did.

Our great standing obligations, such as the national defense requirements, international responsibilities, the public debt, have remained at the same level or have gone higher. Last year, when our peacetime income was as great as in any period in history in this country, the retirement on the public debt was small.

I have brought here (and I will refer only to it for a moment) this chart which I am afraid cannot be thoroughly seen, but I want to merely point out to you something about our thinking for the fiscal year 1949, which starts July 1st of this year. The receipts are expected to be 44.5 billion, of which the expenditures were to run to 39.7 billion with the hope of a surplus of 4.8 billion for the retirement of the public debt, but that will have to be reduced in proportion to the tax reduction which occurred.

These areas, direct taxes from individuals, excise taxes, direct taxes from corporations, miscellaneous receipts customs and other taxes, represent the flow of income to our Government, approximately 52 percent coming from direct taxes on individuals.

What I want to point out more than anything else is that in our planning national defense was 11 billion and it will probably go up to 13 billion. That takes up 28 percent of the total income. International expenditures, at 7 billion, take up 18 percent. The veterans' program at 6.1 billion, takes up 15 percent. The interest on the national debt takes up 13.2 percent and the tax refund takes up 5 percent.

To show you that I am speaking purely extemporaneously, I will have to add up this business myself. That comes to approximately 79 percent. Correct me if I am wrong. That means that 79 percent or a little more of our national income is going out into areas in which expenditures are fixed and cannot be eliminated.

I have pointed those propositions out to point up the fact that these are difficult and perilous times. What does it mean to you at this Congress?

It does not mean that you as individuals or as members of this Congress cannot look forward to the future with confidence. It does not mean that you as an individual or as a member of this Congress cannot do real and substantial planning. But it does mean that your work here at the Congress assumes increased and added importance because it means that the areas of spending which this Government is able to engage in outside of the fixed limits that I have pointed out have become increasingly narrow. It means that individual citizens, as well as governmental employees, must apply themselves more thoroughly and assiduously to the problems of government than they ever have in the past.

I say that because I think that I am speaking here to as representative a group of public servants as can be found anywhere. Whether you are employed privately or publicly, the very work that you do in its very nature and in its ingredients carries with it the essence of public service in one capacity or another. Mappers and surveyors are laying a permanent record that is utilized by local, county, state, or Federal governments now and will be used in the future.

Your record during and prior to the last war speaks for itself. What could have been done in this country in the way of advanced thinking and planning without the work that you ladies and gentlemen were able to accomplish before and during the war is a matter that should be given real consideration in planning for the future. I say that because the basis for my remarks is: "What can be done in the field of public service?" I realize that there are many, many areas in which public moneys can be well spent. Today, demands are tremendously great in view of the fact that we are attempting to carry on a forward-looking program in the light of large standing drains upon the Federal income. We have our great basin developments in the big rivers of this country—Columbia, Missouri—the developments in the Far West in public power. We have the exploration and the preservation of the resources of the great Territory of Alaska, which is being prepared for statehood in the future, we hope.

All those areas require money expenditures.

We have the problem of conserving our natural resources upon which so tremendous a demand is placed. We have the problem of developing synthetic

replacements for our natural resources. In the area of soil conservation and forest conservation in the Department of Agriculture and the development of our resources in the Department of the Interior, we face tremendous problems.

The problem with us in the Office of the President is not how can a dollar be well spent but how can a dollar be best spent. If it were not true that those who come to us come to us with programs that they are convinced will ultimately benefit the United States of America to its greatest degree, the problem of saying no would be simple, but to say no to men who are satisfied that what they ask for is of great and lasting importance to this country is difficult.

In the area in which you are serving and in the area for which you have here gathered, you are in a position to provide us with the information that we need. You are in a position to provide us with the factual knowledge of what development must come first, what development must be retarded. You are in a position to provide us with information as to how the Government may best spend each dollar, and it is in that vein that I am sure that this Congress is working. And I hope that at the end of this Meeting and at the end of your service here with the Congress, you will be in a position not only to give us the benefit of what you have done here, but that you will be able to go back to the citizenry of the places from which you have come and let them know of the necessity of public service at this time and of the glory of public service.

Welcoming Remarks

By DR. ANDRE SIMONPIETRI

SECRETARY, COMMISSION ON CARTOGRAPHY, PAN AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY

EDITOR'S NOTE.—Following the welcoming address by Mr. Pace, Dr. Simonpietri translated the essence of Mr. Pace's remarks into Spanish for the benefit of members and guests from the South American Republics. Dr. Simonpietri also extended a welcome on behalf of the Pan American Institute of Geography and History, and his additional remarks follow.

I also would like to express to you a very warm welcome here. President Wright has suggested that I speak to you momentarily on the relationship which during the years has grown up between the American Congress on Surveying and Mapping and the Commission on Cartography of the Pan American Institute of Geography and History. That relationship, that growth, is very interesting when examined more closely.

The two organizations came into being almost simultaneously. The Commission on Cartography was created in April of 1941; the First Annual Meeting of the Congress was in June of 1941. The two organizations offer to us the proof—which many people have arrived at today—that, normally, to serve the Nation well in a given field, two types of organizations are necessary: The official type of international organization, in which governments are the members and through which programs of international scope can be planned, and executed afterwards, by the individual governments, operating solely or in unison. That

is the official side of the picture. The professional side of the same picture is this group here, in which individuals are members. They make their contributions by studies in standardization, new techniques, new approaches to new problems. Then, in a sort of double capacity, representing the profession and, at other meetings, representing their governments, in a happy marriage which does not often exist elsewhere, they carry forward in an official manner the solutions they have found as professionals.

In the Americas, I feel that we are very fortunate in having at the service of surveying and mapping both types of organizations, because the Commission on Cartography is the official body on which the Governments of the Americas, including Canada, are represented, and this Congress, which has its membership, as your President has just told you, extending from the Arctic to the Antarctic.

The American Congress on Surveying and Mapping was first named the National Congress on Surveying and Mapping. The idea was to include the whole Nation and the various related sciences to surveying and mapping as its fields of operations. It was soon found, however, that the term "National" was quite restrictive. Many confreres and colleagues in Latin America were interested in associating themselves more closely with you and your endeavors. Therefore, the name was changed to the American Congress on Surveying and Mapping, emphasizing thereby that it is a body for all America; and transition from a national organization to a regional international organization was quite smooth.

The Commission on Cartography was created in Lima, Peru, in 1941, at the Third General Assembly of the Pan American Institute, for the purpose of stimulating the mapping activities of the member nations in accordance with their own map needs. Four meetings have been held. All the way through here I see a very interesting parallel and a two to one ratio. This is your eighth meeting, while the official organization has had four. The American Congress was divided into 11 regions; there are 22 participating countries in the Commission on Cartography. There are four Technical Divisions of the American Congress. There are eight technical committees and subcommittees in the Commission on Cartography.

Interest in the two new organizations, both on the part of the professional people and on the part of the governments, has been uniform. You people (and I might include myself if I may so do) have gone forward finding new methods, new techniques, new procedures in the solution of problems that are new. The governments, on the other hand, have gradually become more and more firmly convinced of the need of that basic knowledge which surveys and maps do provide, which were mentioned by Mr. Pace as being the permanent record of your achievement. They have doubled, and in some cases, quadrupled their national budgets for surveying and mapping work. So far as the Commission on Cartography is concerned, the Governments have named their representatives thereon. They have advanced its activities. They have sponsored its meetings.

That international interest is not something which is discernible in one particular spot only, it is visible throughout, and it involves both organizations. Your first President was, and is, the first President of the Commission on Cartography. The Commission was set up, for instance, in Lima. Its first meeting was held jointly in Washington and in Mexico City. Its second meeting was in Rio de Janeiro. Its third meeting in Caracas. Its fourth will be held in Buenos

Aires in October of this year. Ecuador has presented a very interesting project for the construction of an international astronomical observatory to be set up near Quito. The directors of the national mapping organizations of Paraguay, Bolivia, Uruguay, Colombia, to mention a few others that have not already been referred to, are members of your organization. That cross-fertilization of ideas and association runs through the entire record and history of the two organizations.

Personally, I have had an opportunity of visiting all of the countries of the Americas, and of talking both with the people who prepare the national programs, and with those charged with their execution, and have taken part in meetings such as this. From that personal experience, which would simply corroborate your experiences here, I know that this interest in surveying and mapping, this stepped up activity is not a local thing. It is continental in scope.

Therefore, those with us today, from Canada and from the Latin American nations, are here not as guests but rather as colleagues and co-workers in a joint enterprise. I know that we in the United States have learned much from them in our mutual relationships. I trust that they are learning something from us.

Normally, at this point after 7 years, from 1941 to 1948, we would take a sabbatical leave—as in the teaching profession. I trust, however, gentlemen, that you have no such intention, but will move forward in your solution of these problems, bringing to a greater perfection our knowledge of the science and our knowledge of our own national territories.

❦ ❦ ❦

Make Aerial Surveys of Canadian North

THE Canadian Government has already started its annual program of exploration and mapping of the Canadian North, with the announcement that the Royal Canadian Air Force has a number of photographic survey detachments in action.

Two other survey groups, from Aerial Photo Squadron 413, left Ottawa on May 13 for Fort Chimo, on Ungava Bay in Baffin Strait. At that point the group will cover 148,700 square miles of northern country with tri-camera photography and 20,000 square miles with vertical photography.

Topographical surveys on land will also proceed in many parts of the North as a part of the regular activity of the Department of Mines and Resources. Other activities of this department include surveys of industrial mineral deposits and operation of 57 geological survey parties. Geological studies will be made for an international flood control project on the Columbia River and the Geodetic Survey will conduct triangulation work in the Yukon, adjacent to the Alaska Highway, and in the far north of Quebec and Labrador in connection with great iron ore discoveries in that region.

Other special investigations include one already concluded—a special RCAF flight of 21 engineers and scientists across the entire north of the Dominion. Among the scientific tasks accomplished was a survey of ice conditions in Hudson Bay.—*Engineering News-Record*, May 27, 1948.

Maps and Air Photographs—Necessary Tools for State Planning and Development

By FRANCIS A. PITKIN

EXECUTIVE DIRECTOR, PENNSYLVANIA STATE PLANNING BOARD

A FIRST REQUIREMENT in any attempt to plan for the wise use of a state's resources, or to solve the land and water problems of an area, is the availability of accurate information, recorded in convenient form, concerning the topography, drainage system, land use, soil and mineral resources, as well as one or more methods of accurately describing the location of places or areas in the region to be served.

Experience has shown that these requirements can best be met through the availability of the following types of material:

1. Topographic maps
2. Aerial photographs
3. Soil maps
4. Geologic maps
5. Plane coordinate systems

These five basic types of information, the control surveys which must precede them, and the specialized maps derived from them, are essential to efficient operation of State and local governments, as well as to the development of industries and the effective operation of public utilities.

All drainage projects, flood control projects, water supply and power developments, mining operations, land classification studies, locations for industries, railways, canals, highways, sewers, disposal plants, transmission lines, parks and recreational centers and many other industrial and civic developments are dependent upon adequate maps and air photographs. The total value of such maps and photographs to Government agencies, State departments and private individuals defies estimation, but this value is certainly many times their cost.

In one northeastern state it has been estimated that an adequate mapping program could be established and maintained at a cost amounting to only fifteen thousandths of one percent of the value created by the mineral, forest and agricultural industries in each year. Such an expenditure is insignificant in comparison with the benefits which can be gained.

Each year the amount chargeable to inadequate mapping greatly exceeds the yearly cost of a modern mapping program. The citizens pay this cost through increased taxation, higher public utility rates and delays in the construction of needed public works. Items chargeable to inadequate mapping or lack of air photographs range from the excessive costs of highway culverts draining areas smaller than those for which they were designed, to central power plants designed to use more water than is available; from excessive excavation for highway construction to flood damages caused by delays in collecting basic data for the con-

Presented at Eighth Annual Meeeting, American Congress on Surveying and Mapping, Washington, D. C., June 21–23, 1947. Based on a report submitted by the Committee on Topographic Mapping and General Mapping Service to the Association of State Planning and Development Agencies.

struction of flood control structures. The public pays not only for such errors and delays, but also for independent surveys which must be made when adequate maps are not available. These independent surveys are usually not available to or are unsuitable for use by other agencies so that such work is often duplicated.

The value of adequate maps was recently demonstrated in one state in connection with the construction of a highway between two points sixteen miles apart. Three location surveys were made at an approximate cost of $5,000, and the cost of the proposed highway was estimated from these surveys in the usual manner. Before the highway was constructed, the State Geologist appealed to the Governor to have a topographic map, a few miles in width, made along the route of the proposed highway. The topographic map was made at a cost of $2,200, and from it a new route for the highway was selected. The cost of the highway constructed on this new route was $200,000 less than the estimated cost of the route selected before the topographic map was made.

The need for adequate topographic maps was recently demonstrated in connection with a case of industrial development. A river which was paralleled for many miles by a railroad and which contained an excellent supply of water that was not being used, was called to the attention of potential industries. Inquiries were received from at least two important chemical industries which were interested in locating plants in the area because of the excellent supply of water. In both cases, had a development taken place, the initial investment would have been around $5,000,000. In both cases, however, final consideration boiled down to the question of satisfactory plant sites. Inquiries were made as to the availability of topographic maps on which the selection of the most advantageous location for the plant, the planning of the necessary housing facilities, the location and construction of new roads and similar problems could be readily visualized and appraised. When the inquiries were answered to the effect that no topographic maps of the area were available, the matter was dropped. The industries making the inquiries indicated that they could not afford to spend the time involved in making the detailed topographic surveys necessary to selecting satisfactory plant sites, particularly in view of the fact that other areas, for which adequate maps were available, were also being considered.

In addition to these basic maps most states need other forms of base maps as well as specialized maps of various kinds. Most states need up-to-date planimetric maps showing civil divisions, streams and water features, railroads and coordinate grids.

State topographic maps at a scale of from one inch equals six miles to 1 to 250,000, depending upon the size and shape of the state, are needed by many states. Such maps should show county lines, cities, railroads, oil and gas transmission lines, major dams and flood control structures. Plastic relief models at a scale of around 1 to 500,000 would be very useful for display and educational purposes.

County highway maps, compiled from topographic maps and air photographs, are being made by many states, and should be kept up-to-date. Aeronautical charts, providing state-wide coverage as distinguished from the sectionalized Federal charts, are compiled for some of the states.

County drainage maps for use in establishing and controlling legal water levels of lakes and reservoirs are needed by some states, and maps showing the predominant forest types are needed by others.

These are but a few of the many types of specialized maps required by some or all of our states. All have as their foundation the basic maps discussed in later sections of this report.

Maps and air photographs, of course, are not of value unless they are used. In many instances maps have been available, but their existence was unknown to the map-using public. It is just as important to have sources of map information available to map users as it is to have maps.

The Office of Map Information of the United States Geological Survey, Washington 25, D. C., has undertaken this service on the national level. It is obvious that the existence of similar service in each state is highly important.

CONTROL SURVEYS

These are important preliminary requisites which form the foundation and framework on which maps are constructed. The U. S. Coast and Geodetic Survey makes these basic surveys. In programming such surveys, every effort is made, within the limits of the funds available, to have adequate control available in advance of scheduled mapping of other types. This requires careful coordination of the program of the U. S. Coast and Geodetic Survey with the U. S. Geological Survey and state mapping agencies, as well as with other Federal, state and local agencies dependent upon this type of information. A reasonable objective in planning for control surveys is to insure that every point in the state is within six miles of a horizontal control station and 2.5 miles of a vertical control station.

Survey data applying to a number of survey monuments and prominent objects are furnished in connection with the plane coordinate system. The more extensive and detailed the control surveys are, the greater will be the facility and ease with which the plane coordinate system may be used. The basic control system for each state should be extended so that control stations will be available at the spacing indicated in the above paragraph. This will result in more general benefits from the system. Once the basic control at the above spacing is completed, then the individual states can supplement this basic work by additional traverse, triangulation and leveling. Any local surveys in any state, which are urgently needed, should be brought to the attention of the officials of the Federal Government in order that adequate plans may be made to complete such work.

Local control surveys also are made by various state agencies, municipalities, public utilities and corporations. Many of these surveys are of high accuracy and would be useful to other engineers and mappers. The existence of such surveys should be recorded with an appropriate state agency capable of checking the results of these surveys. They should be checked, evaluated and the stations properly monumented.

It is recommended that the U. S. Coast and Geodetic Survey complete the basic control surveys at an early date, and that the individual states cooperate with the Survey in establishing as many measured base lines as are necessary for the rigid adjustment of the triangulation system in urban areas. Sufficient bases are measured by the Survey to insure the appropriate accuracy of the triangulation for normal use, but for urban surveys an accuracy greater than first-order is necessary. For this reason additional measured bases at the periphery of the urban surveys are required.

TOPOGRAPHIC MAPS

These are general maps showing topographic and cultural features and often serving as the base for many special-purpose maps. It is essential that they be available on a state-wide basis, that they be kept up-to-date through remapping programs, and that they be available at scales large enough to meet the development needs of the area.

Such topographic maps are usually a product of the U. S. Geological Survey. Much of this work is financed on a cooperative basis by the U. S. Geological Survey and the mapping agency of the state in question. Topographic surveys are also made by other Federal agencies such as the Coast and Geodetic Survey, the Corps of Engineers, the Bureau of Reclamation, and the Forest Service, to meet specific needs of those agencies when such mapping is not provided by the U. S. Geological Survey. These maps are edited, published, and distributed by the U. S. Geological Survey.

One of the most important considerations concerning a topographic map is its publication scale. Until recently the standard scale for the U. S. Geological Survey topographic quadrangle maps was 1:62,500 (approximately one inch to the mile). During recent years, however, there has been a definite trend toward larger scales, especially in urban districts and in areas where extensive development is anticipated. As a result of this trend, many maps have been published at a scale of 1:31,680 (two inches to the mile) or 1:24,000 (one inch equals 2,000 feet). Of these two larger scales, the latter, which is based on an inch-foot ratio, is rapidly gaining in popularity so that it seems probable that the scale of 1:24,000 may eventually supersede the scale of 1:31,680.

Much of the earlier work done by the U. S. Geological Survey is now obsolete not only because of the more rigid standards of accuracy now required and the demand for a larger scale, but also because of many cultural changes that have taken place since the original surveys were made. Although a little more than half of the United States has been topographically mapped at some time, only about one-fourth of the United States can be considered adequately mapped according to present day requirements.

During World War II several Federal mapping agencies and private corporations made topographic maps in strategic areas of the United States for the War Department. The specifications prescribed were generally similar to those of the U. S. Geological Survey; the maps were compiled in accordance with the national standards of accuracy; and the maps were published as standard quadrangles. In some cases the General Land Office section lines were omitted and in some flat coastal areas the contour interval used was too large for adequate interpretation of the terrain. The War Department's stock of topographic maps at scales of 1:62,500 and 1:31,680 has been turned over to the U. S. Geological Survey for distribution. Other maps which have been published in special scales will be re-issued on standard scales by the U. S. Geological Survey for civil distribution.

It is recommended that each state, in cooperation with Federal mapping agencies, appraise the status of its mapping and determine its needs and priorities for a mapping program. This program should recognize the needs of all map users. (In making such an appraisal, the procedure employed by the State of Pennsylvania, described in "Topographic Mapping Needs," published by the State Planning Board, is suggested.)

It is recommended that the various states urge that the program for completing the topographic mapping of the United States be accelerated in accordance with the plan to complete such mapping within 20 years as presented to Congress by the U. S. Geological Survey, and that the present practice of concentrating the distribution of topographic maps in one Federal agency, namely the U. S. Geological Survey, be continued.

It is further recommended that all military topographic mapping be appraised according to civil requirements and, after the necessary adjustments are made, that it be issued in such form and at such scales, namely 1:24,000 or 1:62,500, as are suitable for civil use.

It is also recommended to the U. S. Geological Survey that existing topographic maps for civilian use which are not now issued at standard scales be re-issued at scales of 1:24,000 or 1:62,500.

It is recommended to the Army Map Service that printing the State Plane Coordinate ticks on the borders of their topographic maps be resumed. These ticks could be placed on the margins beyond the other grid markings, and would be valuable both to military and civil authorities in transferring data from civil to military maps and vice versa.

AERIAL PHOTOGRAPHS

Air photographs should be available on a state-wide basis at scales and to photogrammetric standards suitable to the developmental problems of the area concerned. These may be the product of the State government, the Federal government, private industry or of cooperative programs developed by combinations of such agencies.

Air photography is the basis for most modern topographic mapping, but such air photographs are made for that special purpose with emphasis on stereoscopic effect so as to facilitate their use as a basis for topographic information. These specialized air photographs are not satisfactory for general purpose use.

Air photographs at a scale of 1 to 20,000 taken with a precise mapping camera having a focal length of approximately 8¼ inches are very useful for general purpose use, including, among other things, industrial location work, agricultural land-use analysis, forest and game land management, general highway route selection, preparation of highway and land-use maps, preparation of tax maps and providing the basis for local planning and zoning studies. Enlargements of aerial photographs are often desirable for specific uses and a satisfactory enlargement of four or five times the original scale of the negative can be made. If a photograph larger than a scale of one inch equals 400 feet is needed, it is desirable that the original be at a larger scale than 1:20,000. However, some recent 1:20,000 photography is of such high quality that enlargements to one inch equals 200 feet are satisfactory for many purposes.

Panchromatic film is usually used for general purpose photography, but for areas which are largely forested, infrared film with a minus blue filter is often used for summer photography in order to differentiate between various tree species.

In the study of areas for which topographic, geologic or soils maps are not yet available, air photographs often form a satisfactory substitute. With the use of a stereoscope, the study of overlapping pairs of air photographs gives valuable information on topography. Geologic outcroppings and changes in soil type are often discernible on air photographs of good quality.

Accurate mosaics or air maps composed of an assembly of air photographs are available for many areas and are valuable for many types of community planning or other types of work where the detailed ground culture found on an air photograph is needed for study of a particular area. Some states are already cooperating with the Federal government in securing these mosaics.

It is recommended that each state appraise its air photography needs and develop a program for the acquisition of state-wide air photography, if is does not already exist. This should be followed by a continuing program which will provide for re-photographing a tenth or more of its area each year. Such a program may be a cooperative one with one or more Federal agencies participating.

SOIL SURVEYS

Soil surveys are made by the United States Department of Agriculture in cooperation with state agricultural colleges or state departments of agriculture.

They provide a detailed inventory of soil resources and are generally superimposed on topographic base maps. They show the character, composition, location and extent of the various types of soil and the sub-surface conditions which affect them. They usually involve the study of air photographs followed by detailed ground studies.

Following the completion of the basic soil surveys other types of maps may be developed including detailed analyses of land potentiality, erosion, climate, rainfall, slope of land and other factors which affect soil use.

Soil surveys should be patterned to meet the requirements of the particular area involved. Emphasis should be placed upon the types of data which influence soil use to the greatest extent; factors which have little influence on soil use in a particular area should be minimized or deleted.

It is recommended that the various states appraise their requirements for soil surveys, and determine the kind and intensity of survey needed in each area; and that priorities for soil surveys be determined from economic data.

It is also recommended that soil surveys be programmed by the various states, and that funds be provided for carrying out these programs.

GEOLOGIC MAPS

Geologic maps provide the basis for determining and appraising the mineral and ground water resources, and for predicting how much and what kind of material (deep soil, hard rock, oozing muck) lies below the land surface. Such kinds of information are of economic value in planning industrial or engineering developments. Such maps are made by the U. S. Geological Survey and by the state agencies concerned with geologic research, often on a cooperative basis. The amount and kind of data included in a geologic may and its accompanying report depends upon the type of area and its resources.

Geological mapping should be regarded as a continuing process in which additional data are constantly being accumulated, analyzed and recorded. In mapping of this kind certain phases may be covered in great detail to provide specific information about a commercially important resource, while other phases of the survey can be developed later.

It is reported that only about 7 percent of the continental United States is covered by geologic maps deemed adequate for modern uses. At the present time

educational institutions with expanding enrollments in geology are facing a minor crisis in the shortage of published geologic maps for student use. Moreover, instructors in geology are frequently embarrassed by lack of knowledge concerning the general geology of many areas, knowledge which a thoroughgoing program of geologic mapping would provide. Members of geological surveys and university departments of geology who meet the public are constantly beset by requests for information of the sort presented by a good geologic map; yet for much of the country they are forced to say that no adequate map is available. General coverage of good geologic maps would result in a healthy public appreciation of the natural features of our country and its resources. This would, of course, prove an essential element in the full use of geology in public service. People do not use resources about which they know nothing.

The prime determinant of adequacy of geologic maps for practical uses is scale which determines the amount of detail that can be shown. Therefore, the question to be decided concerns mainly the amount of detail necessary for general practical uses with the two principal factors involved being, first, the complexity of the geology of a specific region and, second, regardless of geologic character, the degree of detail which must be legible on the map for practical use. The scale of 1 : 62,500 is about the smallest scale feasible for modern needs but many areas will have to be mapped at 1 : 24,000 or larger scales to meet specific requirements.

It is recommended that each state reappraise its needs for geologic mapping with the objective of developing the output of needed mineral products and for improving the economic position of problem areas.

It is further recommended that a long-term program for geologic mapping be established for each state and that sufficient personnel be trained for carrying out these programs.

PLANE COORDINATE SYSTEMS

The surface of the earth is not a plane, but a curved surface, containing many irregularities. In geodetic surveying, the earth's surface is assumed to be an ellipsoid of revolution. Geodetic surveying requires the use of expensive field equipment, spherical geometry and astronomy. Through its use the location of points on the earth's surface is expressed in terms of degrees, minutes and seconds of latitude and longitude.

Plane surveying assumes that the surface of the earth is a plane and utilizes moderately priced instruments and lower mathematics in its computations. This is the type of surveying used in determining property boundaries and locating highway developments and other public works.

Plane surveys of different parts of a large area will be differently oriented, depending upon the starting point. This difference is appreciable in this latitude. Plane surveys cannot be fitted together, on a spherical surface, unless they are adjusted and referenced to some common framework. Because of this problem most local surveys, such as those involved in a highway project, are not tied in to any monumented points and cannot be used for any other purpose than to meet the temporary requirements of the construction project. This problem also gives rise to most of the difficulties encountered in determining property boundaries. Such property surveys are usually referenced to a stake in the ground or a tree or some other local landmark which disappears in the course of years, thus

making the re-establishment of the property boundary exceedingly difficult at some later time.

The State Plane Coordinate Systems are designed for transposing data from plane surveys to fit a spherical surface without the use of complicated mathematical computations. Through the use of plane coordinates the location of points on the earth's surface is expressed in terms of feet north and east of an imaginary point well outside of the area for which the Plane Coordinate System was designed.

Surveys referenced to the Plane Coordinate System can be fitted together accurately over large areas, and any point of these surveys can be reestablished from any other referenced point tied into the coordinate system.

Secondary uses of plane coordinates also are valuable and should be popularized. They are used in Maryland by the State Police and other agencies for designating any point in the State, so that it can be located by others without error. This method does not depend on lengthy descriptions and directions to reach a destination. Ambulances, police cars, fire trucks and emergency crews can be directed to any point in the State by describing that point in terms of coordinates, and the use of maps containing coordinate grids.

The Coast and Geodetic Survey has constructed systems of plane coordinates for each state, and computed the necessary tabular data for these systems. By the use of these systems geographic positions can be converted to plane coordinates, and surveys tied to the coordinate system are definitely located with respect to latitude and longitude.

A number of geographic positions obtained by triangulation must be definitely marked and the plane coordinates for each one determined as starting points for use in referencing plane coordinate surveys. In order that a more general use may be made of the plane coordinate systems, the basic control of the Federal Government should, in some areas, be broken down to a closer spacing.

It is recommended that plane coordinate systems be adopted by the legislature of each state and that the supervision of the plane coordinate systems be placed in a competent organization in each state.

MAP INFORMATION SERVICE

In most communities topographic maps are sold by book stores, drug stores or other shops as a side line. Usually the map user, in purchasing a map, has no contact with anyone who has a knowledge of maps and mapping. Geologic maps, soil maps and air photographs have very limited distribution because few people know whether they are available or where they may be obtained.

Few states have centralized map information services or offices which can give full information concerning the availability of maps.

Few states have developed an effective mechanism for collecting and utilizing information which will maintain or improve the quality of maps. There should be a qualified person in each community who would notify the State Map Information Service of changes in landmarks and stations in his community. These changes could be indexed and placed upon base maps. This would avoid confusion arising from changes in location of landmark structures, such as radio towers and highways.

Engineers, mappers, highway maintenance superintendents, state police, county agricultural agents, public utility officials and other map users who travel

extensively over the state should be educated in using map information and noting changes and errors upon them. Preliminary editions of maps should be routed to such persons in order that they may be checked and errors discovered. A map checking section should be provided where new maps of small areas may be checked against master sheets and recorded.

It is recommended that each state establish a map information service where data concerning the availability of all kinds of maps and air photographs may be obtained and to which information on map changes may be channeled for effective action.

It is further recommended that these map information services publish catalogs and other mapping information and distribute them to various engineering societies, colleges, libraries and map-using agencies.

It is also recommended that engineering societies, colleges and libraries be urged to maintain files of maps and indices of air photographs for use by the public.

* * *

Aerial Mapping Cuts Surveying Costs

AERIAL PHOTOGRAPHY is saving cities millions of dollars and months of work, the American Public Works Association reports.

Civilian engineers are taking full advantage of improvements in aerial map-making developed during the war. Aerial photography of cities is being used especially for planning superhighways and land-use studies.

Cleveland officials claim that aerial mapping of that area is saving taxpayers 2 million dollars. By taking pictures from an altitude of 3,500 feet, stereopticon cameras reduce ground surveying to minimum and produce maps with good detail.

The Chicago department of superhighways is using aerial maps extensively in developing the new Congress Street expressway, an eight-mile, eight-lane thoroughfare being built at a cost of 61 million dollars. Air photographs saved considerable preliminary ground work, as the expressway slices through a congested part of the city.

Aerial mapping has been used recently in Atlanta, Fort Wayne, and several other cities undertaking superhighway projects. Use of steropticon cameras and advanced techniques permit determination of building heights and terrain contours with amazing accuracy. Height and depth variations as little as 2 feet can be detected.

The San Diego city planning department is one of the many planning agencies currently using aerial photography. San Diego is using aerial pictures in development of new park and recreation property created by deposits of dredged material in Mission Bay.

Muncie, Ind., is completing revision of zoning regulations after mapping the city by air to determine land use. Several states have prepared air maps for community use. In Pennsylvania, cities and townships including Erie, Lancaster, and Manheim have prepared zoning ordinances based on State aerial surveys.

Air maps prepared before and after highways or other public works have been constructed have proved valuable to state and city governments in damage suits by property owners. The pictures show exactly what property has been damaged and to what extent.—*Engineering News-Record*, June 24, 1948.

Axis War Maps

By WILLIAM E. DAVIES

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DURING the recent war, publicity emphasis in this country was focused on the cartographic efforts of military and government mapping organizations of the United States and its allies, to the exclusion of the work of the Axis governments. The over-all picture of war mapping resulting from concentration on this one aspect is extremely unbalanced.

Of the Axis governments, Germany and Japan figure most prominently in the field of war mapping. Since their work was prosecuted independently and little similarity of approach is evident, it is convenient to consider their efforts separately.

GERMAN TOPOGRAPHIC MAPPING

Germany, like other nations in this war, faced the problem of preparing large-scale topographic maps for military operations outside the area of Germany proper. Since these areas, in general, were not under control of Germany at the time of preparing maps, extensive ordinary ground surveys were impossible, and it was necessary to utilize existing published maps of countries involved in military operations. Under such conditions there are two distinct approaches, either to use existing maps with no change except for factual revisions, or to produce maps based on a universal format and style. Germany followed the first procedure, while in most cases American mapping was patterned after the second.

The arguments for and against the two approaches are lengthy, but in favor of the former there is the fact that a map must depict topographic features which vary basically from region to region, and, therefore, maps produced by each nation best fit the conditions within that nation. Also in war time, it is quite common for later dated sheets to become available as operations progress, and the first approach permits the utilization of such information with a minimum of effort. In favor of the second approach is the value of standardization of format and design that is lacking under the other approach, as well as in furthering the continuity of map sets beyond national boundaries.

In the large-scale range the Germans produced maps at a multitude of scales based on the metric system. Maps on scales of 1 : 25,000; 1 : 50,000; and 1 : 100,000 were standard throughout most of Europe, the only variations being the 1 : 40,000 scale in Belgium, the 1 : 80,000 series in France, and the 1 : 75,000 series in Central Europe. Where original mapping had been done at scales other than the standard, maps were enlarged to the closest standard scale.

Sheet formats, style, and colors of the original maps copied were generally retained, but legends were translated into German with the original language as an alternate. In areas using non-Roman alphabets, geographic names were Germanized. In other areas names were left in original form.

German reprints of large-scale maps include practically all the standard sets of Europe and North Africa which, for many countries, resulted in considerable and useless duplication. Typical are the 1 : 100,000; 1 : 50,000; and 1 : 25,000 scale maps of Egypt covering the same areas which were reprinted, whereas either a combination of 1 : 25,000 and 1 : 100,000 or a single 1 : 50,000 set would

have been sufficient. This duplication resulted from the German idea that a 1:25,000 scale map is for artillery purposes, a 1:50,000 for troop use, and a 1:100,000 for staff levels—an arrangement open to considerable argument.

New map series prepared by the Germans are apparently confined to one set covering the west coast of France at 1:25,000. Considering the development of photogrammetry in Germany this is quite surprising, for over much of the area in which military operations took place the map coverage at large scales was incomplete and inadequate. In the preparation of new maps the Americans and British far excelled the Germans.

German military maps fall into four major classes based on the amount and reliability of data shown. The *Führungskarte* was a simple, sketchy map for planning purposes on which only most basic details are shown. The *Sonderausgabe* showed standard information, but was not considered final or fully adequate, while the *Heereskarte* was an adequate, complete map of accepted reliability. The *Truppenkarte* was a map issued by field units. The terms are not strictly definitive as often the same map will appear both as a *Truppenkarte* and as a *Heereskarte*. Commonly, on maps of 1:100,000 scale and smaller, the Germans combined four or more sheets into one and these were identified as *Zusammendruck*.

The topographic mapping by the Germans clearly reveals certain points. The overlap of scales resulting from indiscriminate reprinting of existing maps involved considerable duplication and waste of effort. The difference in detail between a 1:25,000 scale and a 1:50,000 scale scarcely warranted production of both scales in the same area. Experience gained during the war indicates that a single large-scale series is preferable to a number of overlapping scales.

Contrary to general opinion, the drafting and compilation quality of German maps, with the exception of the *Heereskarte*, was at times very low. On many of the compiled maps the drainage and contours were not compatible and streams crossed hills, ran down the flanks of valleys, or performed other topographic absurdities which tended to lower the reputation of the compilations.

In the production of medium- and small-scale maps the Germans relied considerably upon reprinting existing maps, although new series were commonly produced. The 1:1,000,000 *Weltkarte*, a modified version of the International Map of the World, was the most extensive German map set produced. It covered all of Europe, a large area of the Soviet Union, the Near East, and much of North and Central Africa. The general styling of the International Map was followed, but considerable variations in color and symbolization are evident. The majority of the sheets were based on copies of existing maps, although many new compilations were also prepared. The 1:500,000 *Weltkarte* was similar in style and coverage to the 1:1,000,000 and served as a complementary series.

The 1:300,000 series covering Europe was one of the most universally used topographic maps. Primarily it was an expansion and modification of the standard prewar *Mitteleuropa* 1:300,000 series. Except for the *Mitteleuropa* part of the series the maps were new compilations, based on large-scale maps where available, and on enlargements from 1:500,000 or 1:1,000,000 maps at the extremities of the series.

A number of different series on a scale of 1:200,000 covering parts of Europe were copied from existing maps. These series varied in style and were not continuous, being limited, in general, to national sets.

The medium- and small-scale maps were used extensively as a base for the preparation of special maps such as military geology, water supply, and terrain maps. In Europe the 1:300,000 series and elsewhere the 1:500,000 and 1:1,000,000 series were usually used for this purpose.

Considering the extent of development of photogrammetric techniques in Germany, it is rather interesting to note the comparatively small use made of aerial photos for mapping purposes during the war. This is in sharp contrast to British and American efforts, where photography was of prime importance in revisions and new map work. Spotty revision of the 1:300,000 and other medium-scale series was made extensively by the Germans. The lack of continuity is also evident in large-scale revisions executed mainly on the *Truppenkarte*. Much of the photo revision work was not incorporated in the basic drawings, but was made in the form of an overprint.

Photomaps, on the other hand, were produced to cover much of Eastern Europe at a scale of 1:25,000. The maps were on standard sheet lines and printed in black. Towards the close of the war photomaps were being produced in four colors which included in addition to the black base, light blue for water features, green for forests, and brown for land features. These features when thus presented produced an easily read and clean-cut map.

Aeronautical charts of the Germans differed radically from those of Americans and British, as the Germans produced few map series primarily designed for air navigation. Two series, one at 1:2,000,000 and the other at 1:4,000,000, were the most extensive, and both were on a Mercator projection with only sparse details of culture and topography shown. In contrast to this are American and British charts which, in detail, resemble a topographic map.

The 1:1,000,000 *Weltkarte* and a few medium-scale maps were produced in modified air editions, which included a special grid as well as isogonic lines and airfield information. These and similar air editions were identified as *Fliegerausgabe* or *Fliegerkarte*.

The mapping efforts of Italy and other Axis satellites were negigible and were generally an integral part of the German effort. Italy's participation was limited to topographic mapping of her colonies and homeland, plus a few *Truppenkarte* published by field units of the Italian army. The other Axis satellites similarly were limited in their production to *Truppenkarte* work.

JAPANESE TOPOGRAPHIC MAPPING

For many years, previous to the recent war, information pertaining to Japanese mapping activities for military purposes was a mystery. Rumors were persistent that Japanese maps were faked or were of poor quality and in some cases nonexistent. Much of this confusion was based on a lack of information which, in turn, resulted from the fact that, until recent events forced an alteration, the Japanese considered most maps as secret documents and released few to the public. Material captured during the war shows that these rumors were false and that Japanese mapping efforts compare well with those of America.

During the war the Americans and British tended to standardize the style and design of most maps, often carrying the uniformity to a point approaching stereotyping. The Japanese were just the opposite in this respect, for each series of maps that was produced was designed to fit an individual condition; and

as a result the maps show a variety of colors, symbols, and format. Japanese maps often depicted information quite well, but lacked consistency in the method of showing data.

As did the Germans, the Japanese utilized existing map coverage to the fullest extent by making direct reprint copies of large-scale maps. In the earlier part of the war these copies were generally crude black-and-white reprints with an occasional map showing vegetation in green. In these reprints the original format of the map was retained, but the legend was converted to Japanese text while in later reprints Japanese text was added to the geographic names on the body of the map as well. Extensive reprints of this type were used in the invasion of the Philippines, East Indies, and Indo-China.

As the war progressed the Japanese made colored copies of maps with some minor revisions. These colored copies retained the format, style, and symbolization of the original map except for the Japanese text in the legend and occasionally in the body of the map. It was from such maps that the majority of the military movements and occupational activities in the area controlled by the Japanese were carried on. Towards the close of the war the original style of these maps began to lose its identity, as the design and symbolization were modified to resemble standard Japanese styles.

In the use of aerial photography to produce new maps, the Japanese compared well with their enemies and allies. Both the areal extent and percentage of photography utilized command considerable respect, for all types of photography —from isolated groups of pictures through extensive uniform areal coverage— were fully employed to produce topographic maps or revisions. The quality of Japanese maps produced from wartime photography is fair or good, and in parts of New Guinea and the Philippines it surpasses that produced by American and other forces.

In the East Indies many of the maps produced from aerial photography were based on photographs taken by oil companies and on deposit with the Dutch Survey. On such maps, a combination of Japanese and Dutch styles was followed with place names in Japanese and Dutch.

Elsewhere, with the exception of the Philippines, the maps produced from aerial photography were patterned after the style of Japanese homeland maps. Often these maps were of a strip designed to follow railroads, roads, or shorelines.

Practically all the large-scale maps produced by the Japanese, either from aerial photography or by reprint, were on metric scales, primarily 1:50,000 and 1:100,000. Where original maps were in the British scale systems (1:126,720; 1:63,360; and 1:31,680), they were converted to 1:50,000 or 1:100,000.

Special attention should be called to another phase of Japanese mapping from which military cartographers may well benefit. The Japanese produced many sketch maps of local terrain, derived either on the spot or from aerial photography, and the art of producing such maps was well developed and profitable. Most of the maps were printed by mimeograph or ozalid and indicated the features usually shown on topographic maps with relief delineated by form lines.

In small-scale maps the Japanese tended towards the production of one extensive, standard set. This set, at a scale of 1:500,000 and closely styled after Japanese homeland maps, covered Manchuria, China, Burma, and India. A similar set, but with a slight modification in symbolization, also covered the Philippines, East Indies, and part of the Japanese mandated islands.

The Japanese showed little interest, from a military standpoint, in the International Map of the World except to reprint existing sheets for reference purposes in Europe. In the East Indies isolated sheets were printed, but nothing standard or extensive was prepared. In India a special series of 31 maps on International sheet lines was published covering the country. The 1:1,000,000 East Asia series, which had long been maintained by the Japanese, was extended and revised to serve as a small-scale map of Eastern Asia.

A variety of maps of the East Indies at 1:250,000 scale, produced by the Dutch, were reproduced in facsimile as were the Survey of India 1:253,440 series of Burma and India which were copied at 1:250,000. Similar medium-scale maps covering Australia were copied as rapidly as the Australians could prepare them. Of interest is the fact that many of the reprinted medium-scale Dutch maps containing vital information had not been available in American and British map libraries, although they bore dates previous to 1941, a condition that was typical of our "preparedness" of prewar days.

As mentioned before, American and British aeronautical charts were designed to cover continental areas or the World on a uniform style and format. The Japanese, on the other hand, designed their air charts to cover specific areas of operations. In addition, Japanese air charts were published at a multitude of scales over the same area, a condition that was made more complex in that the army and navy issued their own series which were similar in scale, style, and coverage.

Aeronautical charts were produced by the Japanese (both army and navy) on scales of 1:3,000,000; 1:2,000,000; 1:1,000,000; and 1:500,000. Coverage was available on these charts from Northwestern North America through Eastern Asia and the East Indies, to and including Australia and India. The charts were highly colored with relief indicated by generalized tints and with complete aeronautical data shown by symbols.

Japanese reprints of air charts published by the Australians, British, Dutch, and Americans are frequently found covering the East Indies and Malaya, but, with the exception of the reprints of American charts, these were used primarily as ground maps.

In reviewing the general picture of Japanese mapping, two points stand out. The first is the ability of the Japanese to produce a quantity of well-executed facsimile copies of existing maps in a short time. The second is the ability of the Japanese to utilize a high percentage of available nonuniform aerial photography under war conditions to produce a map of acceptable quality.

On the average, the over-all quality of Japanese military topographic maps is comparable with the average British or American production. The commonest and most apparent error, which at times plagued certain series to the point of being humorous, is the frequent confusion of latitude and longitude values assigned to sheet corners. Also to be noted is the tendency of the Japanese to coin new names to replace the official names of many of the islands that were occupied, an action that has further added to the confusion of names in the Pacific.

MAPPING OTHER THAN TOPOGRAPHIC

German cartographic efforts during the war reached their peak in the production of special-use maps.[1] Such varieties as trafficability, building material,

[1] SMITH, T. R. and BLACK, L. D.: German Geography: War Work and Present Satus, *Geographical Review*, Vol. XXXVI, 1946, pp. 398–408.

and water resource maps found extensive use in military fields, and towards the end of the war had reached such perfection as to make Germany a leader in the field. In general, the special maps were based on standard topographic maps with the additional data overprinted. In this discussion it is not practical to indicate the minor varieties of special maps produced as it is common to find that similar types of maps bear different titles or that maps are a combination of types. There are many types of special maps, such as maps indicating fortifications, that are not unique enough to require special descriptions.

The *Mil-Geo-Karte* (not to be confused with the *Mil-Geo-Mappe*, a similar type of map, which is an integral part of a regional military study) was one of the most important and widely used of German special maps. The map was primarily designed to show communications, including roads and railroads, bridge limitations, military objectives, and major natural features affecting military operations. With few exceptions, the delineation of terrain traffic-ability was subordinated and, when shown, was indicated by text or by symbolization of major obstacles.

Classification of transport routes was extensive, giving complete information as to surface and width of roadways as well as complete data on bridge capacities. Industrial objectives were symbolized as to type of installation. Terrain conditions were indicated in a general way by text, but specific data was seldom shown except for swamps or areas subject to floods.

In the legend of each map was included a tabulation and brief description of military objectives such as bridges, villages, and tunnels which were keyed by numbers to the map. Also, there were brief descriptions of soils, climatic data, ground and surface water, population, construction materials, and similar information of military value. Large-scale city plans, showing information similar to that on the *Mil-Geo-Karte* proper, were printed on the reverse side of each map.

The *Mil-Geo-Karte* was published in rather extensive series covering Europe and North Africa. The base maps in Europe were the standard 1:200,000 or 1:300,000 series, while elsewhere they were the 1:500,000 and 1:1,000,000 *Weltkarte*.

The *Mar-Geo-Karte* (*Nautsch-Geographische Karte*) was supplementary to the *Mil-Geo-Karte* and was very similar in style and design except that the *Mar-Geo-Karte* emphasized coastal features and foreshore and offshore conditions. Coastal areas were classified as to geomorphic form and surface geology with natural obstacles shown by symbols. The character of the ocean floor was shown by tints. As on the *Mil-Geo-Karte*, sufficient text was appended in the margin which described special coastal and hydrographic features as well as supplying auxiliary information on climate and harbors. The maps were published in isolated series covering selected coastal areas and were based on medium- and large-scale hydrographic charts or topographic maps.

The terrain trafficability maps produced by the Germans existed in several forms and under several titles. The simplest form was the *Hinderniskarte*. On these maps major natural obstacles were delineated by symbols with slopes differentiated into groups according to steepness, and river crossings as to water depth, width, and current. Information pertaining to the trafficability of soils was seldom shown, but areas subject to periodic inundation were delineated.

The *Befahrbarkeitskarte* (occasionally titled *Geländekarte*) was a universal trafficability map. Natural obstacles were indicated in a manner similar to that

on the *Hinderniskarte*. Roads were classified extensively as to the traffic they would bear while soils were delineated by tints or patterns keyed to vehicular and seasonal use. In addition, text was used freely throughout the map to amplify the data shown by color or symbol. The *Befahrbarkeitskarte* closely resembled the British and American *Going* maps as to style and data shown, but in coverage the Germans showed far greater development. In Western Europe and Africa much of the area was covered by medium-scale (1:300,000 to 1:500,000) maps in isolated sets or sheets, while extensive coverage on 1:100,000 *Grossblatt* sheets was published for Eastern Europe.

The *Panzerkarte* was a specialized form of trafficability map developed in the latter part of the war. Complete terrain classification was not indicated except where it was not normally traversable, but road and bridge data, as well as information pertaining to natural obstacles, were shown as on the *Befahrbarkeitskarte*. In addition, forests were indicated by tint and classified according to size of trees, while information as to limits of flooding of rivers was shown by test. The *Panzerkarte* was issued in small sets covering a few isolated areas in central Europe and formed but a small part of the trafficability maps.

Trafficability maps reached their peak in the production of the *Geländebeurteilungskarte* which, like the *Panzerkarte*, appeared late in the war. This type of map showed data of the same form and style as the *Befahrbarkeitskarte*, but which was more highly differentiated and definite. In coastal areas information normally found on a *Mar-Geo-Karte* was also added. In general, the *Geländebeurteilungskarte* was published in single sheets over special areas at medium scales and was not part of a uniform series.

The most specialized and limited in scope of the trafficability maps was the *Uberschwemmungskarte* which showed the limits of flooding along sections of principal rivers. The base was a large-scale map, overprinted in colors to indicate the limits of seasonal floods and highest floods. This type of map covered but a few selected areas and formed only a small part of the trafficability maps.

In the preparation of road maps the Germans utilized many of the commercial road maps of Europe and North Africa as a basis of their publications as shown by the extensive facsimile reprints of Michelin, Freytag and Berndt, Italian Touring Club, and similar standard road maps. Special road maps of selected areas, prepared to give information as to road widths, surfaces, and clearances, were seldom in series and were individual unrelated sheets at medium or small scales. Small-scale general maps were also prepared to cover continental areas and presented the outstanding characteristics of the road network.

The hydrologic maps prepared by the Germans fell into two distinct types. The *Wasserversorgungskarte* (*Grundwasserkarte*) was designed to give information as to ground water supply. The data were shown by contour lines drawn on specific water horizons with additional information, such as soil and water horizon profiles, indicated by columnar diagrams at selected points. Facilities such as pumps, wells, or springs were symbolized, and in many cases their capacity and quality indicated. On smaller scale maps the water horizons were keyed to geologic formations and general information as to depth, volume, and quality were indicated.

The second type was the *Gewasserkarte* which was a map of surface water conditions. Width, depth, and current of streams, important bridges, fords, and natural obstacles were indicated by symbol.

The majority of the hydrologic maps were at medium or small scales and generally in single, isolated sheets. Exceptions to this were extensive sets covering parts of France on 1:500,000 and 1:25,000 and some on 1:300,000 in Eastern Europe. Extreme variations of style as well as title were common in the hydrologic maps, but such variations were not basic and the maps can be grouped into the two types outlined above.

The German *Baustoffkarte* was in reality a highly specialized economic geology and geography map. Generally it was a special overprint on an existing topographic base with the economic data indicated by symbols. Locations of quarries, prospects, lumber resources, and similar economic information were indicated by symbols, differentiated as to the economic mineral or rock concerned. On many sheets these data were keyed to a text that gave additional information as to the size and state of development of the various installations shown. On some *Baustoffkarten* the areal extent of strata of economic importance, such as dolomites or limestones, were delineated as on normal geologic maps. In addition to the economic geology data shown, information pertaining to cement works, iron furnaces, and similar installations of the mineral industries were indicated by symbols.

Most of the *Baustoffkarten* produced were isolated sets or sheets designed for a special area. Two notable exceptions were the 1:300,000 *Baustoffkarte* series, which was a uniform series covering much of Eastern Europe, and the 1:1,000,000 series covering the same area.

The *Stellungsbaukarte* was a map specially designed to indicate the utility of terrain with respect to military defenses. As on other special maps, information was generally overprinted in symbol or color on existing topographic bases, with soil information and natural barriers, such as cliffs, classified as to their military use in fortifications. Ground water conditions—especially the depth to water horizons and areas subject to flooding—were indicated where they would directly affect fortification or defenses.

As in the case of most other special maps, the *Stellungsbaukarten* were in small sets or isolated sheets. One series, however, was very extensive, covering much of Eastern Europe and based on the standard German 1:100,000 (*Grossblatt*) sheets.

Wehrgeologische Karten were by far the most general and universal of the special maps. On this type of map geologic or soil formations where shown by color and patterns and formed the basis for classification of other data. Other information such as water supply, trafficability, and building materials were keyed to this basic data by an accompanying table. Symbols were used to indicate natural obstacles, and on some maps extensive data on surface and ground water were shown in a manner similar to that on the *Gewasserkarte* or *Wasserversorgungskarte*.

The *Wehrgeologische Karte* was published in series or sets far more universally than other types of special maps, and coverage is available over much of Eastern and Central Europe in comparable series. The bulk of the *Wehrgeologische Karte* is in the medium-scale range of 1:200,000 to 1:500,000, although both larger and smaller scales are common.

In addition to the special maps noted above numerous reprints of standard geologic, soil, vegetation, and water resource maps were made as a supplement to other publications.

The Italians did little in the way of special map work for, as in topographic

mapping, the Italians used German material primarily. Maps similar to the *Mil-Geo-Mappe* were produced as part of Italian military geography studies of the Balkans, but the only appreciable independent cartographic result was the trafficability maps of Libya on a scale of 1:400,000, and even here German influence is reflected in the use of duplicate text throughout the maps.

Japanese special mapping differed greatly from that of the Germans. In place of numerous highly specialized maps, each designed to show a specific feature, the Japanese published maps in which all the elements were combined on one intelligence map.

The intelligence maps were published in sets covering considerable areas and, except for the base map, were similar in style. The base map was a standard topographic map and varied from area to area. The intelligence data consisted of information similar to that shown by the Germans. Roads were highly classified, giving width and surface where the data were available. Information as to surface water features was shown in a manner similar to that on the *Gewasserkarte*. Terrain, vegetation, and other special features were generally indicated by text while data similar to that of *Baustoffkarte* was seldom shown. The scales of the intelligence maps were generally 1:100,000 or 1:500,000. An exception to the above is a scattered group of water and sanitation maps that were prepared to show information similar to that of the *Wasserversorgungskarte*.

In this brief discussion it has been possible to cover only the broadest phases of Axis war mapping, and even this by the use of extensive generalizations. Many minor variations in characteristics, titles, and coverage have been ignored in order to retain the over-all picture. Detailed studies on Axis war mapping are yet to be made, but indications are that such studies will be of immense profit to American cartographers, both military and civilian.

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Arizona Land Surveyors' Conference

THE fifth annual meeting of the Arizona Land Surveyors' Conference was held at Phoenix, Arizona, in January 1948. Postwar mapping was given special attention with detailed reports and discussion by the Postwar Mapping Committee. Other important subjects discussed at the meeting were the status of the mapping program in Arizona by the U. S. Geological Survey, mapping methods, and the availability of existing maps to map users. Attention was given to map requirements for highway design and reclamation projects, as well as the establishment of a mapping program for Arizona, including priorities.

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Fifth Regional Surveying Teachers' Conference

ENGINEERS, educators, and instrument manufacturers gathered at the Green Engineering Camp, Ringwood, N. J., in the Ramapo Mountains, for the Fifth Regional Surveying Teachers' Conference on August 26th to 28th. The conference, which was sponsored by the American Society for Engineering Education and the Cooper Union for the Advancement of Science and Art, was the first of its type to be held in 8 years.

Papers and discussions included boundary surveys, legal aspects of surveying, the State Plane Coordinate Systems, photogrammetry, and new developments in methods and equipment.

Use of Prism Permits Point Location Without a Transit

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SURVEYING TEXTBOOKS describe several methods for locating points from a traverse or from a measurement line, but many of them provide for no check on the accuracy of the work. Therefore, if an error is made in one of the tape readings or in recording a reading and there is no other check, it is impossible to disclose the mistake by plotting. Some of these methods are not convenient for accurate plotting, and if the rectangular coordinates of the points are needed they are sometimes difficult to compute. Furthermore, almost all of these methods require the use of the transit which in turn requires a transitman and, where it is necessary to locate many points, considerable time is lost in transporting and setting up the instrument.

Most of the objections to the use of the transit for locating points from a traverse or measurement line can be overcome by employing an instrument called the double pentagonal prism. The use of the prism is more economical (the field party can be reduced to two men) and less time-consuming and, at the same time, provides sufficient accuracy as well as a check on the location of each point.

A double pentagonal prism (fig. 1) is a small instrument the size of an average plumb bob but considerably lighter. It consists of a small cylinder within which two prisms are mounted in fixed positions. The cylinder is provided with four windows, two in front (one upper and one lower), one on the right side, and one on the left. Clear images of two objects located 180° from one another with respect to the position of the observer are provided—the one from the right side in the upper front window, and the one from the left in the lower front window. The light rays coming from the right and left sides are broken and reflected by passing through the prisms so that they will be turned through angles of 90° before emerging to the view of the observer. On the bottom of the instrument there is provision for attaching a plumb bob. The prism is attached to a cord which can be looped around the neck like the cord of a policeman's whistle. Upon completion of an observation the prism is released to hang from the neck, leaving the hands free. To use the instrument requires no more than an hour's training. The usual prism (Winkelprisma) designed to turn light rays by reflection through 90° angles may be used to produce results which will be accurate, according to W. Jordan (Vol. II, p. 49, Stuttgart, 1931), to within approximately 1′. Thus, in making a perpendicular offset of 100 feet or less, the error (deviation) will be very small.

Location of points with a prism.—The ends of the traverse or measurement line,station *A* and station *E* (fig. 2), must be signalized with vertical range poles. A distance is then measured by taping along the line, from station *A* to a point approximately on a perpendicular from the line to point *D*, which is to be located. The head tapeman (party chief) turns so that he faces point *D*. The instrument, with attached plumb bob, is held in his right hand. He looks in the front windows of the prism and moves forward or backward until the images of the

two range poles on stations *A* and *E* come exactly into a line, one under the other, in the two front windows. The instrument is then on the traverse or measurement line. Then, still facing point *D*, which is signalized by a range pole held by the second tapeman, he moves to the right or to the left along the line until the range pole on point *D* is aligned with the images of the range poles at stations *A* and *E*, which are already seen in the front windows of the prism. He is then at a point which is the base of a perpendicular erected from the measurement line to point *D*. The location of this point (point *C*) is marked with the plumb bob and a measurement is taken with the tape to determine its plus station. The perpendicular offset (point *C* to point *D*) is measured next—using a

FIG. 1

second tape if it is convenient to do so. The head tapeman records the station plus and offset distance in his notebook and measurement may be continued along the line until a "full station" is reached and marked.

Immediately before or after locating a point (as point *C*), the plus station to a convenient check point (as point *B*) is determined, and a tie distance is measured from it to the point to be located. This check point should be chosen so that the angle between the tie (*BD*) and the measurement line or traverse side is between 30° and 60°. From the triangle *BDC*, in which distances *BD* and *BC* are known, the length of *CD* can be computed afterwards in the office, thus providing a check on the measured perpendicular offset distance to point *D*. Another check may be made by measuring distances between neighboring points

which have been located (such as point *D* and the next point) and comparing them in the office with computed distances determined by simple trigonometric calculations.

After completing the measurements at points *B*, *C*, and *D*, the second tapeman moves his range pole to the next point to be located and measurements are continued along the traverse or measurement line to a point approximately opposite it. The head tapeman then proceeds to locate this point in the manner described above and the necessary check measurements are recorded. Since measurements to all points along the traverse line are taken as plus stationing, all recorded distances along the line are directly related to the beginning point at station *A* (figs. 2 and 3).

To obtain the best results in locating points with a double pentagonal prism the positions of the angle stations of the traverse lines should be chosen so that: (1) the sides of the traverse will be as near as possible to the points to be located; (2) distances between angle stations of the traverse (sides of traverse) will be approximately equal, but one side of the traverse should never be more than

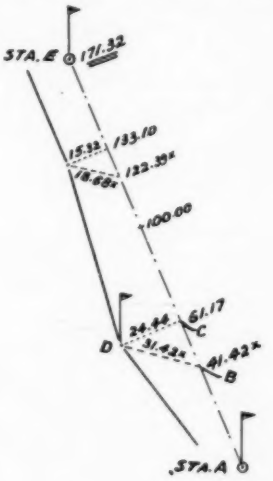

FIG. 2

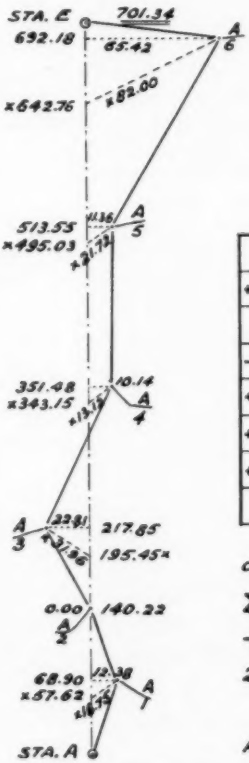

FIG. 3

	y_n	$x_{n+1}-x_{n-1}$
+	12.38	140.22
	0.00	148.95
−	22.81	211.26
+	10.14	295.70
+	11.36	340.70
+	65.42	187.79
		1324.62

CHECK FOR $\Sigma(x_{n+1}-x_{n-1})$

$\Sigma(x_{n+1}-x_{n-1}) = 2S - -[(x_1-x_0)+(x_n-x_{n-1})]$

$2\,\text{AREA} = \Sigma y_n (x_{n+1}-x_{n-1}) =$

$= +16071.0548$

$\text{AREA}_{A-E} = +8036$ sq. ft.

three times the length of an adjacent side; and (3) acute angles in the traverse will be avoided. The two latter stipulations tend to provide more consistent and accurate measurement of the traverse angles.

Formulas and computations.—Suppose the problem is to determine the area of a tract for future subdivision. The complete traverse has been run in the field with a transit and tape and the corners of the tract located with a double pentagonal prism, as described. In the office, the traverse is closed and the coordinates of the traverse stations computed in the usual manner. The area bounded by the traverse sides is computed also in the usual way, but the problem is to find the actual area contained within the boundary lines of the tract. To accomplish this, the small areas to be added or subtracted from that bounded by the closed traverse are computed for each side of the traverse separately. This computation will be made with the aid of the formula:

$$\text{Area} = \Sigma y_n \ (x_{n+1} - x_{n-1}) \div 2 \qquad \text{(Fig. 3.)}$$

In this formula $x_{n+1} - x_{n-1}$ is the difference between the following and preceding plus stations of the point n. The notation y_n represents the perpendicular offset of the point and must be taken as plus when it lies outside (left, following the traverse in a clockwise direction) of the traverse side. It is taken as minus when it lies inside (right) of the traverse side. This computation can begin on any of the traverse sides but must progress in a clockwise manner to each succeeding side until the station of beginning is again reached. When, in this manner, all areas lying between the traverse sides and the boundary lines have been computed, they are added to or subtracted from the area enclosed by the traverse previously determined.

The coordinates of the traverse stations have been computed. If the coordinates of the points located by using the prism are needed—for instance, those along the traverse side between station A and station E (fig. 3)—they can then be computed by the formulas in figure 4, in which:

x_A, y_A, x_E, y_E are the previously computed coordinates of the beginning and end stations of our traverse side.

x_p, y_p are the coordinates of the point located with the prism, which must be computed.

x^n, y^n are the plus station and the perpendicular offset of the point located by use of the prism.

s is the length of the traverse side between A and E.

The computation is made on the form shown in figure 4. First, the known coodinates of stations A and E are written in columns 6 and 7. The differences between these ($x_E - x_A$ and $y_E - y_A$) are then found and α and β are computed. Next, columns 2 and 3 are filled in with the appropriate values of x^n and y^n. Then, using the formulas given at the top of figure 4 for x_p and y_p, the necessary computations are made for columns 4 and 5, and columns 6 and 7.

All of these computations can be made rapidly with a calculating machine.

Plotting.—The traverse may be plotted by any of the usual methods described in surveying books. However, since the coordinates have been computed for the traverse stations they offer the best method of plotting. The points located by prism may be plotted by coordinates or by the plus stations and per-

pendicular offsets, either by the usual plotting methods or with the aid of special instruments, of which several are available—for example, "Coordinatograph for Detail Points," "Maizik Triangles," etc. The use of these instruments is especially recommended when it is necessary to plot a considerable number of points. The instruments cannot be here described in detail for lack of space. However, with all of these instruments the plotting can be done quickly and accurately.

It can be seen that the double pentagonal prism provides an accurate method for locating points from previously established traverse lines and that for each located point there is a check, as described. The work can be done more rapidly with a prism than with a transit and, by eliminating the transit, the necessity for a transitman is also eliminated. Also, the survey party can be reduced to

$x_p = x_A + \alpha x^n - \beta y^n$ WHERE $\alpha = \frac{x_E - x_A}{S}$

$y_p = y_A + \beta x^n + \alpha y^n$ $\beta = \frac{y_E - y_A}{S}$

y_n CAN BE PLUS OR MINUS DEPENDING ON WHETHER THE POINT "P" IS ON THE RIGHT OR LEFT OF THE TRAVERSE SIDE.

POINT	$x^n = x_n - x_{n-1}$	$y^n = y_n - y_{n-1}$	$+\alpha x^n$ $-\beta y^n$ $+\alpha x^n - \beta y^n$	$+\beta x^n$ $+\alpha y^n$ $+\beta x^n + \alpha y^n$	COORDINATES x	COORDINATES y	POINT
1	2	3	4	5	6	7	8
A					+ 899.251	+ 71.208	A
			+ 68.842	+ 2.829			
A/1	+ 68.90	+ 12.38	− 0.508	+ 12.370	+ 967.585	+ 86.407	A/1
			+ 68.334	+ 15.199			
			+ 71.260	+ 2.926			
A/2	+ 71.32	− 12.38	+ 0.508	− 12.370	+ 1039.353	+ 76.965	A/2
			+ 71.768	− 9.442			
			+ 77.565	+ 3.187			
A/3	+ 77.63	− 22.81	+ 0.936	− 22.791	+ 1117.854	+ 57.361	A/3
			+ 78.501	− 19.604			
			+ 133.517	+ 5.486			
A/4	+ 133.63	+ 32.95	− 1.353	+ 32.922	+ 1250.018	+ 95.769	A/4
			+ 132.164	+ 38.408			
			+ 161.933	+ 6.653			
A/5	+ 162.07	+ 1.22	− 0.050	+ 1.219	+ 1411.901	+ 103.641	A/5
			+ 161.883	+ 7.872			
			+ 178.479	+ 7.333			
A/6	+ 178.63	+ 54.06	− 2.219	+ 54.014	+ 1588.161	+ 164.988	A/6
			+ 176.260	+ 61.347			
			+ 9.153	+ 0.376			
E	+ 9.16	− 65.42	+ 2.686	− 65.365	+ 1600.000	+ 100.000	E
			+ 11.838	− 64.989			
	$\Sigma(x_n - x_{n-1}) = 701.34 = S$	$\Sigma(y_n - y_{n-1}) = 0$	$\Sigma \alpha x^n - \beta y^n = +700.748 = x_E - x_A$	$\Sigma \beta x^n + \alpha y^n = +28.791 = y_E - y_A$	$x_E - x_A = +700.749$ $\frac{x_E - x_A}{S} = \alpha = +0.9991573$	$y_E - y_A = +28.792$ $\frac{y_E - y_A}{S} = \beta = +0.0410528$	

FIG. 4

two men, as was described in the article "Prism Device Eliminates One Man From Surveying Party" (*Civil Engineering*, May 1948). Accurate plotting can be obtained with the special instruments mentioned above and computations of areas and coordinates of located points can be made quickly by using a calculating machine. Also, the work of the computer and of the checker in the office is rather simple, since it can be done by following the simple formulas and prepared forms, and the triangles used in making check computations of the point locations are right-angle triangles.

It appears that the use of the prism instead of the transit may be from 30 to 40 percent more economical than other methods in common practice and that the degree of accuracy obtainable is very satisfactory. The practicality of the double pentagonal prism has been accepted in Europe for many years, where it has been used in connection with survey work requiring a rather high standard of accuracy in cities and towns.

Newly Patented Camera Uses Two Films at Once

SNAPSHOTS can be taken either in color or in black-and-white with the same camera, simply by turning a knob; or any other combination of two different kinds of film can be used, in the invention of which Walter D. Teague of New York has received U. S. patent 2,439,112.

The trick is very simple. There are two film-exposing frames set back to back, with film-roll holders at either end. The entire setup is mounted in a pair of light-tight metal circles at either end, and a knob or key is provided to bring either frame into position behind the lens, as the operator may desire.

Rights in the patent have been assigned to the Eastman Kodak Company.—*Science News Letter*, May 22, 1948.

Drafting Pencil

A MECHANICAL DRAFTING PENCIL recently developed offers new features. It is so designed that the draftsman has full vision at the pencil point at all times. The leads are propelled through a spring tension point which keeps them from turning, wobbling, or slipping. This point holds the lead tight at the point of writing. There is only one operating part, nothing to get out of order and nothing to break under ordinary use. The tops of the pencils are colored to indicate the degree of hardness of the leads being used. For example, a green top would indicate the pencil is loaded with 4H leads, etc. With this method, the draftsman can quickly select his pencils without possibility of confusion. Drafting leads for these pencils are available in six degrees of hardness: F, H, 2H, 3H, 4H, 5H. Listo Pencil Corp., Alameda, Calif.—*Civil Engineering*, May 1948.

A Graphical Method of Calculating Meridional Parts for Mercator's Projection

By NORMAN PYE

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IT WOULD APPEAR that both understanding and ability to cope with the construction of Mercator's projection by the nonmathematical student have been less complete than is possible simply because the calculus involved has been thought of only in its symbolic form. It is possible, however, to appreciate integration by geometrical illustration and achieve almost the same result by use of this graphical solution.

In introducing these notes it will suffice to recall that the unique property of Mercator's projection is that any straight line on the chart represents a line of constant bearing on the earth. For this property to be achieved two conditions must be fulfilled: (1) meridians must be represented by parallel straight lines; and (2) the projection must be orthomorphic, i.e., the scale is the same in all directions at any point. If *straight* lines are to cut all meridians at the same angle —if they are to have a constant inclination or bearing to the meridian—the meridians must be represented by parallel straight lines. But any straight line crossing parallel meridians will *appear* to be a line of constant direction. The angle to the meridians on the chart will represent the true angles to the meridians at successive latitudes on the earth only if the scale of both parallels of latitude and meridians is the same at all latitudes. Only when this condition exists is the relationship of the apparent or charted easting to the apparent or charted northing—made by any given line of bearing—the same as the relationship of the real easting to the real northing on the earth (fig. 1).

To obtain orthomorphism—to preserve the correct ratio of unity between the scale along the meridians and the scale along the parallels at any latitude—it is necessary, first of all, to determine how scale along parallels varies with latitude. A circle of constant latitude on the sphere follows an East-West course—it is at a constant angle of 90° to the meridians—and so on the projection it will be represented by a straight line at right angles to the meridians. The series of parallels of latitude will thus form a set perpendicular to the parallel meridian lines.

The scale along successive parallels may be determined very easily. Figure 2 represents a section through the globe along the meridian *NPLE*. Points *P* and *L* represent two latitudes along this meridian and *PA* and *LJ* are perpendiculars from the parallels to the polar axis. The relative lengths of parallels are clearly proportional to their radii, i.e., to distances such as *CE*, *JL*, *AP*, etc. Although on the globe, with convergence of meridians, the length of one degree or minute of longitude decreases in this proportion towards the pole, on the Mercator chart, with meridians parallel straight lines at right angles to the Equator, the length of one degree or minute of longitude is kept constant all over the projection and is the same as at the Equator. Parallels *P* and *L* in figure 2 would have lengths $2\pi AT$ and $2\pi JY$ respectively and the increases in their scales, i.e., the ratio between the charted and the true-to-scale length of the parallels on the sphere, are given by the proportions $AT:AP$ and $JY:JL$. A simple graphical

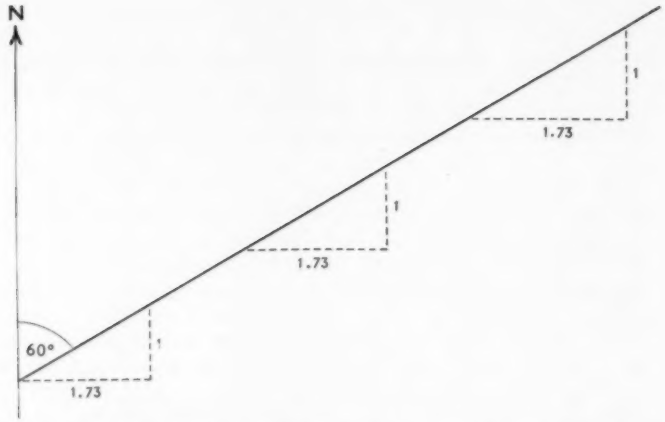

FIGURE 1.—A straight line on the earth at a given angle to the meridians may have its inclination to the meridian spoken of in terms of the relationship of northing to easting. Thus a line bearing 45 degrees will always make 1 mile easting while making 1 mile northing; a bearing of 60 degrees will make 1.732 miles easting while making 1 mile northing, etc. On Mercator's chart the scale is the same along parallels and meridians at each point so the relationship between the easting and northing of a line of constant bearing is preserved. Thus a straight line on the chart, which of course cuts all meridians at the same angle, represents a line of constant bearing on the earth.

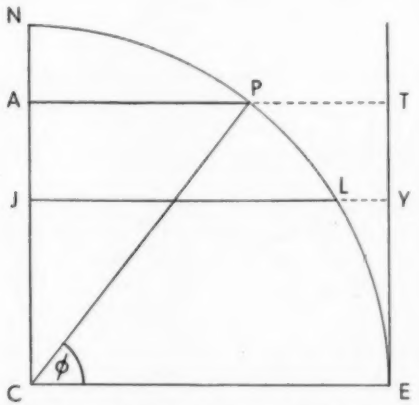

FIGURE 2.—Section through globe along the meridian *NPLE*.

method of ascertaining the value of the scale increase at any latitude is to draw a quadrant of a circle (fig. 3) as large as conveniently possible, on millimeter graph paper with the two radii CE and CN representing the equatorial and polar axes lying along the X and Y coordinates of the graph, respectively. By setting off

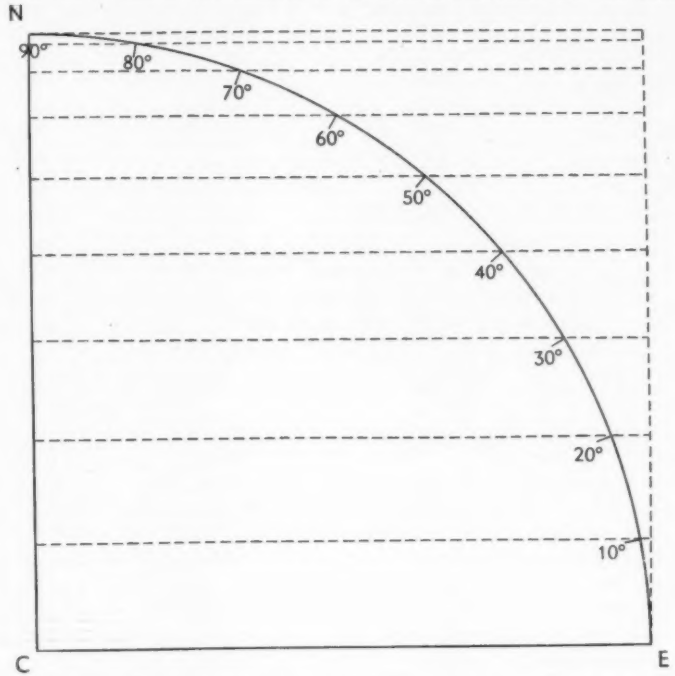

FIGURE 3.—Graphical method of determining the value of the scale increase at any latitude.

an angle from the center equal to the latitude, the position of the latitude on the quadrant is fixed. Intervals of longitude are to be enlarged to a length equal to those on the Equator so the increase to the scale of the parallel will be given by dividing the radius of the Equator (the radius employed in the construction) by the length of the perpendicular from the latitude to the polar axis, a value which is easily determined by inspection of the graph. This proportion can be determined for any latitude, and if this relationship is thought of as the "secant"[1] we shall have a neat, convenient, and mathematically acceptable way of referring to it.

[1] The mathematical basis of this graphical method will be clear from figure 2. On the globe the length of a parallel $\varphi = 2\pi R\cos\varphi$. On Mercator's projection this is made equal to the length of the Equator which is $2\pi R$ so the scale is given by $2\pi R/2\pi R\cos\varphi$ which equals $1/\cos\varphi = \sec\varphi$. On the constructional diagram $AP = CP\cos\varphi$ which equals $CE\cos\varphi$, so quantities such as CE/AP also equal the secant of the latitude.

A quadrant drawn with radius 180 mm. gave the following results:

Latitude (°)	Projection length of parallel (A)	True length of parallel (B)	Exaggeration of latitude scale (A/B)
0	180	180	1.000
10	180	177.3	1.015
20	180	169.2	1.064
30	180	155.9	1.155
40	180	137.9	1.305
50	180	115.7	1.556
60	180	90.0	2.000
70	180	61.6	2.922
80	180	31.3	5.751
90	180	0.0	infinity

We can now consider the scale along the meridians. It will be clear from the above that preservation of the correct ratio (1:1) between the scale along the meridians and the scale along the parallels at any latitude requires the meridian scale to be enlarged by the secant of the latitude. This may be illustrated by a series of unitary crosses on the varying scales of successive latitudes, e.g., ·+++·. It can be readily appreciated that this variable secant increase must apply to an infinite series of points of latitude,[2] that it results in a continuously varying scale along the meridians, and the actual separation between the Equator and any parallel is the result of the summation of the enlargements according to the secant of the latitude of every intervening point. This summation, to produce the spacing of the parallels, is the essential problem of Mercator's projection. The integral calculus provides a rapid and easy way of achieving this putting together of the vast number of small quantities, of infinitely small magnitude, that go to make up the total required; but a graphical method can be utilized not only to achieve the same result by more easily understandable methods, but also to serve as an introduction to meridional parts, by use of which all Mercator charts are constructed in Hydrographic Offices.

From what has been written above it will be clear that the relative spacing of parallels on Mercator's projection, determined by integration of secant increases, is a fixed relationship which can be expressed numerically. The scale adopted for the mid-latitude of the projection simply determines the actual separation of parallels without changing their mutual relationships. Since varying the mid-latitude scale simply varies the size of the pattern of the parallels, it is convenient to have their separation from the Equator expressed in terms

[2] If this is not immediately obvious it may be helpful to think of each element of length, say each degree, along meridians on the projection as consisting of the true length of the arc to scale plus an added portion which is the amount of increase in length due to the secant increase proper to its latitude. The spacing of a particular parallel from the Equator depends, therefore, on adding together the length of the total number of the elements of arc between it and the Equator, and adding to this the total amount of the additional length of the sum of the secant increases as far as the particular latitude, e.g., from 0° to 40°. Here a difficulty will probably suggest itself at once, and this should make the basic problem clear—the beginning and end of each element of arc have different latitudes, and this is true no matter how small the elements or arc are, and so in theory the elements of arc successively considered should be an infinite series of infinitely small arcs, i.e., points of latitude.

of some unit of length measured along the Equator and these values may be tabulated for universal reference. The part of the Equator employed as the unit may be a degree or, as is the practice in tables for hydrographic chart construction, a minute of longitude. Since the spacing of parallels along meridians is specified as so many times the element or part of the Equator adopted as the standard unit, such values are naturally called meridional parts. Having adopted a scale for the meridian interval used as the unit part, and its chart length found, the application of this constant factor to the tabulated figures provides the distances required for plotting the projection.

The graphical summation of the secant enlargements for successive points of latitude required for determination of the relationship between the length of one degree along the Equator and the separation of other parallels is demonstrated in figure 4. Along the base of the graph *EN* represents the 90 degrees between the Equator and the pole. At *E* a perpendicular *EH* represents the value of one degree of latitude and longitude at the Equator—the value of the "part" to which other distances are to be referred. The relation between the length of the initial part and the length of one degree at any other latitude is the product of the length of the meridional part and the secant of the latitude. This secant of the latitude may be determined graphically as explained above with reference to figure 3. By plotting the values of a series of one-degree lengths at various latitudes as perpendiculars above the base, and joining the points by a smooth curve, the resultant graph represents the secant increases to the scale of the meridians (figure 4). The relation between the initial part and the value of one degree, at the infinite series of points of latitude, is represented by the perpendicular distances from the curve to the base line, and can be determined for any point of latitude. Now instead of the

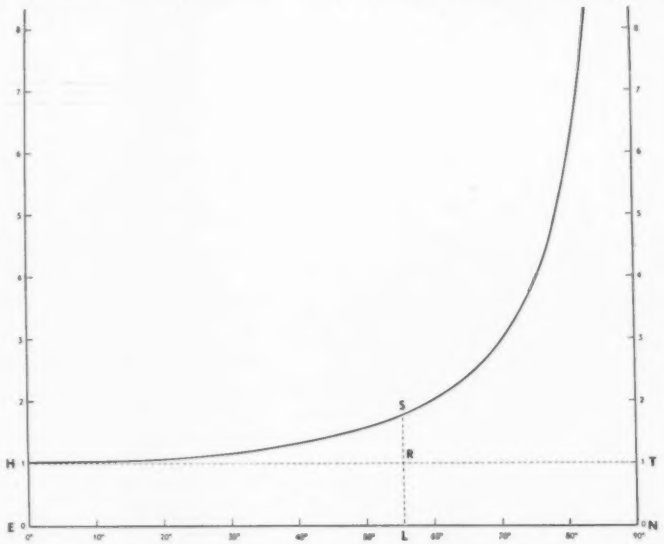

FIGURE 4.—Graphical summation of secant enlargements for successive points of latitude.

secant curve let us consider the graph to be made up of a series of rectangles,[3] on small portions of the degree for bases, and heights equal to the secant values of the latitudes of one of their sides. The sum of all these rectangles would give the product of one-degree *part* with the length of the total secant increases involved. If the bases of these rectangles are taken smaller and smaller, the steps between successive rectangles will become smaller and smaller, until in the limiting case when the bases are a series of points the steps vanish and merge into a smooth curve—the secant curve. The condition still holds, however, that the total area, i.e., the area below the curve between the Equator and the perpendicular from a particular latitude, represents the product of the degree *part* and the sum of the secant increases to that latitude. If the graph has been plotted on graph paper the area under the curve up to a particular point, e.g., within figure *EHSL* for latitude *L*, can be determined by counting the squares, and any such projection upwards of a latitude division to intersect the secant curve embraces an area which represents the integrated or summed total of the whole series of secant increments up to that latitude. Its separation from the Equator in terms of the unit *part* adopted will be given by dividing the total area of the figure below the curve at the point by the value adopted for the unit part on the graph. The number of parts so found to be scaled along a meridian to determine the spacing of the parallel are, of course, its meridional parts.

The accuracy obtainable in the graphical determination of meridional parts depends on the size of the unit adopted for the *part* and also on the scale on which the plotting is carried out on the graph. If, as above, one degree is taken, the meridional parts built up from this will be values in terms of one degree of arc along the Equator. If the graph were sufficiently open to permit minutes of longitude being shown there would be greater accuracy resulting from the closer control over estimates of area.

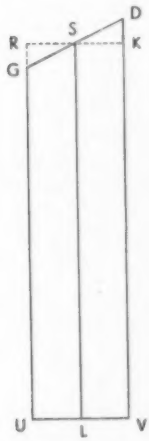

FIGURE 5

[3] The graphical approach here outlined may be used to demonstrate the validity of the numerical method of adding the secants of the mid-latitudes of successive short elements of latitude.

Let us consider a small portion of the secant curve between *G* and *D* (fig. 5) which are so near together, i.e., whose latitudinal separation is sufficiently small, that the small portion of the curve between them is practically straight. The separation of the parallels *U* and *V* in terms of the basic "part" is represented by the area of the figure *GDVU*. But it is clear that a rectangle *BUVK* on base *UV* and with height *SL* equal to the height of the secant of their mid-latitude *L* will equal the original figure within very small limits of error. (On the assumption that over short distances the secant curve is sensibly a straight line the curve becomes a transversal between the two parallel lines through *S* and *D* and it follows therefore that the two figures *SGB* and *DSK* are identical triangles.) If then the continuous secant curve is considered to be a series of columns on small bases, and with heights equal to the mid-latitudes of these bases, the summation of the increases so obtained will clearly approximate to the summation of increases obtained by measuring areas contained between the base and the secant curve.

Although an approximate method (and one which gives always too large a value because of the concavity of the secant curve) it is capable of very good results if the successive elements are sufficiently small; thus for one-degree intervals the table appended shows the error to be less than + 0.7%.

TABLE 1.—*Comparison of meridional parts obtained from graphic determination and from calculation.*

Latitude	Area on graph	"250" Meridional parts	Meridional Parts	
			By mid-lats.	By spheroid
0	0	0	0	0
2	500	2.000	2.000	1.987
4	1000	4.000	4.003	3.976
6	1500	6.000	6.011	5.970
8	2001	8.004	8.026	7.972
10	2506	10.024	10.051	9.983
12	3015	12.060	12.088	12.008
14	3526	14.104	14.141	14.047
16	4044	16.176	16.211	16.105
18	4565	18.260	18.303	18.183
20	5094	20.376	20.418	20.286
22	5629	22.516	22.560	22.415
24	6169	24.676	24.733	24.576
26	6719	26.876	26.940	26.770
28	7279	29.116	29.184	29.003
30	7849	31.396	31.471	31.278
32	8431	33.724	33.804	33.600
34	9027	36.108	36.189	35.973
36	9637	38.548	38.631	38.404
38	10262	41.048	41.135	40.897
40	10905	43.620	43.709	43.460
42	11566	46.266	46.359	46.101
44	12248	48.992	49.093	48.826
46	12953	51.812	51.922	51.645
48	13683	54.732	54.854	54.569
50	14442	57.768	57.903	57.609
52	15236	60.944	61.081	60.779
54	16066	64.264	64.404	64.095
56	16936	67.744	67.891	67.575
58	17852	71.408	71.563	71.240
60	18822	75.288	75.446	75.118
62	19852	79.428	79.572	79.238
64	20953	83.812	83.977	83.639
66	22133	88.532	88.709	88.369
68	23413	93.652	93.828	93.485
70	24803	99.212	99.409	99.065
72	26337	105.348	105.552	105.209
74	28052	112.208	112.393	112.053
76	29977	119.908	120.120	119.789
78	32207	128.828	129.011	128.694
80	34832	139.328	139.492	139.202
82	38009	152.036	152.280	152.037

Once the principle of this method has been appreciated certain devices may be employed in practice to permit more conveniently sized graphs. Thus on the larger and more open scales there would be no need to represent the rectangle *EHTN* developed by the vertical height of the *part;* only the secant curve need be drawn and then to the area found below the curve at any latitude an addition, simply calculated, can be made for the rectangle produced by the scale of the *part* and the latitude in question, e.g., *EHRL* in figure 4. Nor indeed need the scale employed for the vertical axis, the secant axis, of the graph be the same as that employed for the degrees along the *X* axis, provided that in dividing areas to discover meridional parts cognizance is taken of the areal value of the rectangle produced by the *part* along the *Y* and the *part* along the *X* axis.

EXPLANATION OF TABLE I

The areas and resultant meridional parts determined from the graph represents the accuracy obtainable by a single estimate. Estimates of areas by other individuals will be found to vary within only narrow limits and the probable error of a single calculation is therefore low.

The table of meridional parts by mid-latitudes has been produced by the enlargement of each 2° of latitude by the secant of the average or mid-latitude and adding together these short distances to successive latitudes.

The table of meridional parts in the last column shows values obtained by rigorous calculation by calculus based on Clarke's figure for the spheroidal earth.

A working graph based on figure 4 was constructed to a scale of 5 mm. to one degree of latitude along the *X* axis and 50 mm. to one unit along the *Y* axis.

Anglo-American Conference on Geographical Nomenclature

EARLY IN SEPTEMBER 1947 the United States Board on Geographic Names (the USBGN) expressed its willingness, through a member then in London, to send a small delegation to hold informal discussions with the Permanent Committee on Geographical Names for British Official Use (the PCGN). A meeting was immediately arranged and five members of the USBGN arrived in London by air on October 5. Discussions with representatives of the PCGN were held in the Society's House on October 6, 7, 9, and 10. On October 8 four members of the United States delegation and the Secretary of the PCGN went to Cambridge to confer with Professor Sir Ellis H. Minns and Mr. J. M. Wordie.

The London discussions were held under the Chairmanship of Dr. Meredith F. Burrill, Director, USBGN, and Professor H. A. R. Gibb, Interim Chairman, PCGN. A memorandum of agreement between the two bodies was drawn up and is now under consideration by the full Board in Washington and the full Committee in London. It deals with the transcription and transliteration of non-Roman scripts and alphabets, the status of various forms of geographical names, the preparation of gazetteers, the possibility of economical cooperation in the treatment of problems of geographical nomenclature by the English-speaking nations, and the ultimate possibility of practical measures of agreement between all nations. If ratified by the USBGN and PCGN the memorandum of agreement will be published in due course.—*The Geographical Journal*, January 1948.

Land Surveys in Michigan

By GEORGE D. HENNING

ROSCOMMON COUNTY SURVEYOR

THE ORIGINAL U. S. General Land Office Survey of Michigan, which was made between about 1830 and 1855 and is, for the most part, about 100 years old, fixed the section lines and section corners, the half-mile or quarter-section corners on the section lines, and the intersections of the section lines with the shores of lakes, sizable rivers, and existing lines of private claims. All land titles, land boundary and corner locations, and all land ownership histories and records in the State are founded upon and are dependent upon this survey except, of course, such private claims as were in existence and recognized at the time. This is fundamental and the basis for all court actions pertaining to land titles.

It is the function of any land surveyor making subsequent land surveys to retrace the lines and to restore the section corners or other public land corners established by the Land Office Survey, so far as it is possible to do so from the available evidence of their original positions. He must also carry out the scheme of the subdivision of the sections into their subdivisional parts in the same manner as was intended by the original survey. All excesses and deficiencies found to exist between the present day surveys and the records of the original subdivision must be proportioned and prorated in the manner set forth by State laws and published rules of the U. S. General Land Office (now the Bureau of Land Management).

The Land Office Survey, made under wilderness conditions, was based upon comparatively lax controls and employed relatively inaccurate measuring methods. Often, there are considerable variances between the actual locations of lines and corners as established and the locations as set forth in the field notes of the original survey. However, although errors were made in the Land Office Survey, as evidenced by comparisons of measured distances and bearings with the original field notes and records, the locations where lines or corners were originally placed must be adhered to. This is imperative as the land was patented to the original owners on the basis of these boundaries.

When the General Land Office Survey of the State of Michigan was made, metal or other substantially permanent markers were not available. In nearly all instances wooden stakes or posts were cut from saplings and driven into the ground to mark the corners. Most of the State was timbered and trees, usually two, near each corner were marked as "bearing trees" or witnesses. The Land Office notes contain descriptions of each corner and its witnesses, the compass bearings and distances from the corner to the bearing trees, the compass bearing of the line, and distances (in chains and links) from the beginning of the line to prominent topographic and physical features encountered in running it. These features provide the first order of evidence to be found by the surveyor for determining the true position of an original line or corner. In cases where all physical evidence has been obliterated or destroyed, other data must be considered—the most important being notes and records of surveys made from time to time since the original survey which have been properly preserved and

authenticated. Lines of long and generally accepted existence or occupation are also given due weight as evidence.

In order to lay off or set apart a fractional part of a section, it is necessary to first recover, by accurate surveying methods, the bounding lines and corners of the section, as established by the Land Office Survey. Upon completion, the subdivision of the section is made in the manner indicated by the charts of the original survey and according to rules established by the U. S. General Land Office, the State laws, and rulings of the courts. Such rules are based upon the principle of proportioning any excess or deficiency found to exist between the records of the original U. S. Land Office Survey and the findings of the subsequent survey.

The Land Office Survey was made by the government at public expense and a record of it was furnished the State. The State, in turn, gave to each county a copy relating to land within that county. Public land corners, as established and marked by the original survey, are public property and, therefore, deserve protection and preservation. As the State was settled—when highways were being built, land was being cleared for farms, and timber was being cut—it would have been no large or costly task to have marked all corners of the original subdivision more permanently and to have made supplemental records from which their locations could always be recovered if obliterated or lost. Except in a few localities in the State, this was not done. Neither the public nor its agencies became sufficiently concerned with the preservation of survey records or realized how valuable they would be in years to come. In nearly all cases where public records perpetuating original corner locations are found, they indicate ethical integrity on the part of the surveyor who made them and portray his appreciation of their future value.

It can readily be seen, due to the long period of time which has elapsed since the original survey was made, that the natural disintegration of wooden stakes, trees, and tree stumps necessitates very careful search in order to find any physical evidence of the original survey markings. In addition, when it is remembered that little or no effort has been made by the counties or other public agencies to preserve and perpetuate survey markings, either on the ground or by records, it is not difficult to understand why the sum and total of evidence now available to the surveyor is meager or why such heavy demands are made on his diligence, ability, integrity, and judgment. The public thus pays for its past laxity, for the surveyor, in order to produce accurate findings and conclusions, must spend much time in laborious retracement work.

In many instances later surveys have established and marked section lines and corners, as well as many of the interior subdivision lines and corners within the sections. Roads, fences, various types of corner markings, and other evidence now identify these lines. Unless public records, showing that such corners and lines were established by qualified persons and in conformance with the proper procedures and surveying practices, as required by law to be kept in each county, they cannot be accepted as correct without first being proved by actual survey.

Conditions such as these are contrary to the public interest. The laborious retracement of the original subdivision procedures is paid for by the landowners who have the retracement surveys made. If no records of a public nature are made of these surveys, then the landowners still lack a convenient legal means for substantiation or defense of their claims to the boundary lines and corners

as established or restored. Settlement of any controversies which may arise later through adverse claims can only be settled by a duplication of the work and expense.

With inadequate standards governing the qualifications required of land surveyors; inadequate enforcement of the regulation of practice; inadequate provisions for the preservation of land boundaries, corners, and the records of land surveys; and with a general lack of appreciation of the value of such provisions by the general public and public officials, it is found that every surveyor is left to set up his own standards and creeds. This, naturally, results in there being about as many different working policies as there are practicing surveyors.

Land increases in value as it is put to more valuable use. Only a few years ago, except in the more thickly settled areas, it was bought, owned, and sold by the fractional part of a section. The quarter-quarter section was usually the smallest unit used. In more recent years the ownership pattern is being broken up more rapidly into smaller tracts of all shapes and sizes, especially near community centers, along main highways, and along lakes and rivers in the resort areas. As a result, there has been a great increase in the number of the so-called "metes-and-bounds" descriptions. The 1929 Plat Act was a legislative attempt to curtail the metes-and-bounds type of descriptions and conveyances, but it has been only partially effective and the trend in some areas is reaching alarming proportions.

A metes-and-bounds description of land is supposed to describe a starting point and then describe the bounding lines by distances and directions. To lay out such a tract it is first necessary to define the limits of the subdivision of the section of which it is a part. If no reliable records are in existence which show that the section has been previously and properly subdivided and that the lines and corners of the subdivision have been established and marked, it becomes necessary to make a section survey before attempting to locate the parcel within it.

In many cases where the regular subdivision of a section has been broken up into irregular tracts and sold to several owners over a period of time, the metes-and-bounds descriptions in the conveyances were made by persons who did not have the data needed or who were not qualified to prepare adequate land descriptions. Perhaps no consideration was given to an existing excess or deficiency or to conditions resulting from overlaps or to incompatibilities with descriptions of adjacent land. Irregular tracts caused by highways, railroads, lakes, or streams are often found poorly or improperly described, leaving much to interpretation of the intention of the description.

In any case the surveyor is faced with the necessity of delving into the history of other conveyances of land within the subdivision. Such records as he may bring to light relative to previous surveys, lines, and corners are used in interpreting the descriptions of the land to be surveyed and adjacent ownerships. If adequate records are available he should be able to arrive at sound and reasonable conclusions which will provide the client with a valid claim to the boundaries of his ownership, which must be consistent with the rights and equities of the adjacent land owners. To be upheld by the courts, judicious processes of reasoning and arriving at conclusions are necessary.

The present State laws pertaining to land surveys and surveyors are few and entirely inadequate. The ones that are in existence are not enforced and are

pretty generally ignored. This lack of proper laws and proper enforcement can be charged to the lack of understanding and appreciation of the values involved by the general public and local officials.

Sections 1391 to 1402, inclusive, of the compiled laws of 1929 are a part of the laws enacted in 1846 pertaining to county organizations, which make provision for the office of county surveyor in each county of the State. They not only provide for the election of a county surveyor, but outline the duties of the office, the principal stipulations being that he make all land surveys in the county, keep records of them, and turn the records over to his successor in office. The law gives the general principles to be followed in retracing the original government survey and the subdivision of sections. Although brief, they are based on principles laid down by the U. S. General Land Office. The acts also cite some qualifications required in the surveyor.

It is to be remembered that this law was enacted to meet the requirements in 1846, at a time when the Land Office Survey was new and plainly marked. It does not provide that the county surveyor draw any salary or compensation from the county or even occupy a county office. However, the county was supposed to provide him with a book in which to keep his records.

What actually happened in most cases was that a county surveyor, when elected to office, continued to hold such office without opposition or effort as long as he cared to, or as long as he lived in the county and did survey work. This was because there were few surveyors and usually there was no competition for office. His records of surveys, if he kept any such records, were kept with his personal effects, and after many years were considered by him to be his personal property. Little thought or care was given the matter by the public or public officials and when the surveyor left the county or died, his records were often lost or sold to a successor as personal property. However, in some counties some of the past county surveyors made their records public and they are now available. There are a few counties in which there are no survey records except those of the Land Office Survey, and in some there are two or more surveyors who have private sets of records that disagree on certain corners and lines, creating arguments and lawsuits.

At the present time many counties do not have an elected county surveyor nor a registered land surveyor who will do private land surveying. In these counties surveys are made by any surveyor who will come into the county and he usually makes no record of his work. Furthermore, many of the elected county surveyors do not make public records of their work. In counties where there are survey records, they may be found in the Register of Deeds Office, the County Road Commission Office, a surveyor's private office, or in some other public or private custody. All in all there is no uniformity in the offices of the county surveyors or in the policies or practices of the surveyors in the different counties—either in making surveys or in the survey records, or in the place and manner in which the records are kept. Surveyors, other than county surveyors, apparently feel little responsibility to the public for their acts, and their attitudes vary greatly.

Act 149 of the Public Acts of 1883 was an enabling statute whereby the board of supervisors of any county could employ a surveyor to re-mark, with a permanent type marker, section corners and quarter-section corners in danger of being lost, and to make a public record of his work. The act "provided how-

ever'' that it should not apply to any township unless the township, by popular vote, appropriated money to cover the costs, not to exceed $250. That law was not very effective because the need was not clearly shown and, consequently, people were little concerned.

Act 292 of 1907 and Act 312 of 1921 were also enabling acts, permitting the Commissioner of the State Land Office and the Director of Conservation, respectively, to employ surveyors to make retracement surveys and re-mark lost or obliterated corners if requested by and paid for by the local governments. This was resorted to in a few instances. Under Act 292 the records were to be filed in the State Land Office only. Act 312 provided that the notes were to be filed in the Department of Conservation and a copy of them in the county records of surveys.

In many cases where the Department of Conservation has made extensive surveys in and near State forests and other State lands, the surveys have been made by men who were not registered surveyors, and no records of their work have been filed in the county records. Requests to the Department for copies of such notes have been ignored and, upon inquiry, it has been learned that no notes were ever made and filed in the Lansing office. Some notes were made for filing in the Forest headquarters buildings, but usually these were not signed or dated by the surveyor and there is little information as to why corners were placed where they are now found.

Act 334 of 1919, with subsequent amending acts, is known as the Registration Act. It provides for the registration of all professional engineers, architects, and land surveyors who can qualify under the provisions of the act. It stipulates the education that a surveyor must have, but no stress is placed on his practical knowledge in this special branch of engineering, and nothing is said as to his public responsibility in connection with surveying laws. Many professional engineers were automatically given registration as surveyors even though they knew very little about the work except how to use surveying instruments.

Act 172 of 1929, known as the State Plat Act, is a complete revision and expansion of the old plat law, and is the most modern and up-to-date law pertaining to surveying we have. However, it has no proper fundamental law for a foundation and contains many loosely worded and unenforceable conditions.

Act 314 of 1941 was hastily put through, and even though it was intended to serve a worthy purpose, it was so wrapped up in routine and red tape that it has proved to be next to worthless. The Act provides that any surveyor who has occasion to locate a section corner or quarter-section corner (a public land corner), must mark such a corner with a permanent marker and make and file a record of it and accessory data in the office of the Register of Deeds of the county. This would have been very fine if the Act had stopped at that point. However, it goes on to provide that the permanent marker is to be made of bronze, of a specific size and shape, affixed to a pipe of a specified size in a specified manner; the bronze top must be cast with certain letters and legend, must be stamped with certain numbers and symbols by the surveyor, including his name and the date, and must be set in the ground in a certain manner. The markers are to be made by the State Prisons Industries and to be contracted for by the county board of supervisors and furnished to the surveyor at cost. The surveyor must furnish them to the client at cost and in many cases he would be forced to set corners only remotely connected with his client's land. The net result is that nothing

has been done about compliance, for most of the boards of supervisors do not yet know such a law exists and the prison industries have not made any such markers. The Act, through its own cumbersomeness, defeated its purpose. What may be used to mark a corner is of little consequence so long as it is reasonably permanent and an adequate description of it is provided so that its position can always be found. A minimum standard could have been provided, leaving to each county board authority to make such specifications as were considered appropriate for that county. Some counties have standards which are inconsistent with the Act.

The hit-and-miss character of the existing laws and the lack of laws providing for any degree of standardization, has left the surveyor very much upon his own. Therefore, we find a great variance among surveyors as to their practices, methods, attitude toward public records, business ethics, and fees charged for their services.

The present-day surveyor, from the nature of the work he is called upon to do, definitely has a public responsibility. When he determines the locations of the lines and corners of the land belonging to his client he also marks the boundaries of the adjacent owner. These all have a relation to the U. S. General Land Office Survey lines and corners. Since, in the course of his work, he may restore or re-mark or alter or obliterate some evidence of the original markings, his acts affect other interests than those of his client.

This being the case, there should be uniform rules and regulations pertaining to his practices which would be reasonably applicable to all counties of the State, including the preparation of records of work affecting public land corners and lines. There should also be more rigid control over the qualification of persons licensed to make land surveys, and provision should be made for the rigid enforcement of such regulations.

By summarizing briefly the foregoing, the intention of governmental action over the past years may be more clearly understood. First, the U. S. General Land Office Survey is the basis of all land ownership boundary designation and, as such, must be preserved and perpetuated for all time. Second, responsibility is placed upon the professional surveyor to provide the skill, integrity, and professional ability required to preserve the results of the original Land Office Survey. Third, local government should properly concern itself with the values involved, requiring that the surveyor do a good job and that he preserve the records of his work. However, it is also seen from the foregoing that, in spite of legislative intention, local governments have failed, to a large extent, to properly concern themselves with the matter. In turn, the surveyor has felt that he had no reason to unduly burden himself with the public's interests so long as the public did not show concern. The legislature, in turn, has felt no justification for concern so long as local government displayed no interest. The surveyors, as a professional body, have had no unity or organization until 5 years ago. They can now speak up for improved conditions and bring matters to an issue.

The lack of proper preservation of the General Land Office Survey adds greatly to the difficulty and cost of making property surveys and introduces a large amount of controversy which leads to useless lawsuits. In turn, the courts find it difficult to obtain definite facts and data upon which to make proper decisions, due mainly to the lack of adequate descriptions of corner and line loca-

tions which should have been preserved over the years as the result of surveys made subsequent to the Land Office Survey. Unless due recognition is given to the importance of such records now, the condition will become much more complicated in the future.

Little can be gained by pointing out the weakness or inadequacies of the present laws and conditions unless it can be shown that the improvements are possible and feasible.

If provisions were made for the following general measures, they would go a long way toward making up for past laxity as well as provide data of highest value in the years to come.

1. Establish proper recognition of the necessary qualifications of a land surveyor. Provide means of supplying enough qualified surveyors to meet the demand. Bar unqualified persons from engaging in such work and creating unofficial lines and corners and inadequate and erroneous land descriptions. Educate persons for land surveyors instead of permitting any or all persons with civil engineer schooling or good instrument training to become registered land surveyors.

2. Set up the office of county surveyor with the means and facilities to properly provide for and protect the public interest in land surveys and the records of such. Provide him with powers to cause land surveys to be recorded and protected.

3. Make it mandatory for the several counties to provide themselves with a qualified county surveyor and set up the conditions of the office within certain minimum standards and adequately provide for the needs of the county. Adopt such standards of markings and records as will meet the needs of the county.

4. In all counties or areas where there does not now exist a complete record of the accurate location and marking of all U. S. General Land Office Survey corners and the lengths and bearings of the section lines, appropriations should be made to have a qualified surveyor make a retracement survey and properly locate and mark all Land Office Survey corners. He should also locate such other corners as might be desirable and compile adequate and complete notes and a map of such. These surveys should be reviewed by the courts and if found proper and adequate, fixed by decree to be the points which they are claimed to be.

5. All public agencies in possession of land should be required to have their land corners properly placed and protected. They should have their corners set or fixed by the county surveyor, or under his jurisdiction, and file records of all such with his office.

6. Any surveyor, doing any work which will in any way affect any land lines, corners, or records, should be required to file a complete and detailed report of his work with the county surveyor. The county surveyor should be empowered to require his conformance to county standards, so far as public land corners are affected.

7. Adequate records should be kept of the layout and location of public works so far as rights-of-way, etc., affect land ownerships or corners and lines. Such records should be filed with the county surveyor and kept as public records.

8. The office of the county surveyor should also be charged with the task of keeping an up-to-date tract book of land ownership and the compilation of the assessment records of the county. Tax maps and tract books should be made simultaneously.

9. All land descriptions of a metes-and-bounds nature which are newly created, after these provisions are effective, should be subject to approval by the county surveyor before being eligible for recording.

10. Candidates for the office of county surveyor or deputy should be required to be properly registered before taking office by election or appointment and held accountable for proper performance of their duties.

Much of the foregoing could be carried out by acts of the county board of supervisors. Such provisions as would affect State agencies would have to be enacted by State legislation.

Actually some of the counties would do nothing. Although others might do something, rarely would any county set up an adequate and workable arrangement. It would therefore seem to be preferable to set up, by legislative act, basic requirements to which every county would have to conform, but these should be left flexible enough so that the counties could meet the individual requirements and still accomplish the prime objective.

The proper re-marking and remeasuring of the lines and corners of the original Land Office Survey is definitely a duty and function of the municipality or the county, because all such lines or corners affect many ownerships of land. It is unjust for a landowner who desires his land properly defined to have to pay the costs of the research and surveying which is necessary to determine the actual size and shape of the whole section in order to set apart his particular part when other landowners in the section and adjacent sections derive a definite and similar benefit. Such is the case at present and the result is that much land is sold and subdivided and developed in a haphazard manner because of the high cost of proper surveys. Many surveyors establish lines and corners in a manner contrary to their better judgment, or without sufficient data to make a proper location, for the simple reason that the client does not or cannot pay for the cost of properly doing the job. Such surveys are constantly the cause of disputes.

Assessing officers and other persons who make up tract books, etc., but who are not properly qualified or have insufficient data for preparing descriptions of real estate may create erroneous land descriptions. These in turn cause errors in assessments, instruments of title, etc. Abstractors, without maps and proper records, cannot properly identify or segregate lands found in land descriptions, and the examination of abstracts is very difficult in many cases due to a lack of adequate records, maps, and similar data.

At present there are no requirements that a surveyor show that he has followed proper surveying procedures in fixing the boundaries of lands being platted. Many plats are now found that indicate erroneous relationships between a tract of land and a section or its subdivisions, resulting in questionable titles to parts of the tracts.

Under present-day conditions it is not uncommon to find that three or four surveyors may disagree as to the proper location of a line. This is usually due to the fact that every surveyor seems to have a different concept of the proper surveying procedures. Uniform methods would certainly lead toward uniform results. There is little differential in the measurement of distances and angles, but considerable in the theories and policies of surveyors as to retracement of the original surveys; in the evaluating and weighing of findings and evidence; and in understandings of adverse possession, riparian rights, prior conveyances, and other legal documents.

Certainly under present trends corrective measures must be made without delay. The issue will eventually be forced, but only after conditions become intolerable and irreparable damage has been done. The public is now paying heavily and getting but a smattering of benefits.

A Method for Producing Shaded Relief From Areal Slope Data

By ARTHUR H. ROBINSON

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THERE has been no fundamental advance in the precise and yet visually effective map representation of the form of the land since Cruquius, Buache, and others of the eighteenth century gave cartography the basis for the modern contour. Subsequent developments by Lehmann, Dufour, Peucker, Eckert, and a number of others, have contributed systematic foundation to the portrayal of the land surface; but the two basic aspects of morphometry, elevation and slope, seem so far to have been more or less mutually exclusive. In the majority of cases when the two have been combined, slope has been indicated impressionistically rather than precisely.[1] When the delineation of slopes has been the primary aim, as in the Lehmann and Dufour systems and the less well known Punktsystem of Eckert,[2] the reading of numerical values from the representation is nearly impossible. However effective an impression a map technique may produce, it falls short of the ideal if it does not lend itself to precise reading.

During recent decades the study, measurement, and depiction of relative relief and slope have received increasing emphasis from American geographers.[3] Techniques for the determination of average slope values for comparatively large areas have been evolved of which the Wentworth formula seems to be at present the most readily usable.[4] Since geographical research interest in slope has been primarily in its function as an aspect of area, the desirability of producing numerically legible shaded relief from areal slope data suggested itself.[5] The

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[1] LYONS, H. G.: Relief in Cartography, *Geographical Journal*, vol. 43, 1914, pp. 233–248, 395–407, especially the discussion on pp. 398–407.

ECKERT, MAX: *Die Kartenwissenschaft*, Bd. 1, Berlin and Leipzig, 1921, pp. 535–540.

[2] ECKERT: op. cit., pp. 585–590.

[3] A good summary of slope and relative relief techniques and their application has been included by Guy-Harold Smith in The Relative Relief of Ohio, *Geographical Review*, vol. 25, 1935, pp. 272–284.

[4] WENTWORTH, C. K.: A Simplified Method of Determining the Average Slope of the Land Surface, *American Journal of Science*, Series 5, vol. 20, 1930, pp. 184–194.

[5] Research was originally undertaken before the war as part of special graduate study at The Ohio State University under the helpful supervision of Prof. Guy-Harold Smith. The publication of its results at this time, prior to further experimentation and testing, seems warranted by the increase of interest in the problem of landform portrayal brought about by the war. Particularly the "growing-up" of the aeronautical chart is being accompanied by more than passing concern with the possibilities of shaded relief. See articles appearing in *Photogrammetric Engineering*, Dec., 1945 (Robert H. Kingsley and Howard C. Holmes: Terrain Representation from Aerial Photographs for Aeronautical Charts, pp. 267–271; J. E. Mundine and Hal Shelton: Visual Topography, pp. 272–278; and William T. Reagen: Shaded Relief Maps in the German Air Force, pp. 278–282.)

dot was selected as the experimental medium (fig. 1) since it is both easy to produce and reproduce, and when numbers of them are used they may be counted to give precise information.[6] In the system here suggested the area to be shaded

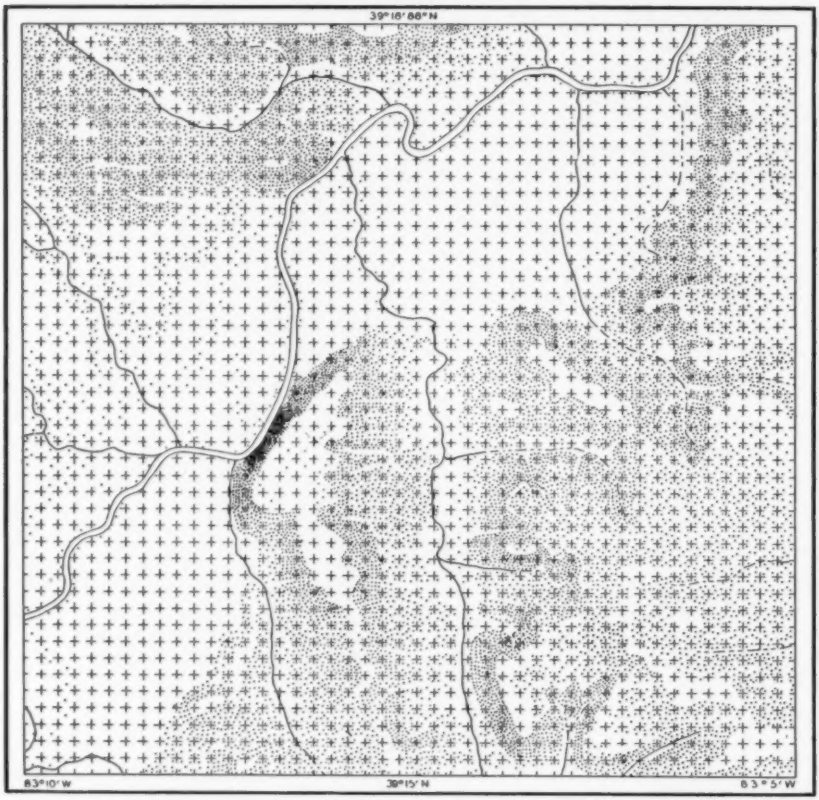

FIGURE 1.—Each dot represents one degree of slope. The group of dots within a square is the estimated average slope of the square. Each square is 1/10th mile on a side and has an area of 6.4 acres.

[6] There are only three basic media for the graphic expression of precise data, *viz.*, (1) The iosgram, (2) the chorogram, and (3) the point symbol. (For definitions of these see J. K. Wright: The Terminology of Certain Map Symbols, *Geographical Review*, vol. 34, 1944, pp. 653–654.) Neither the isometric line nor the isopleth is usable with intrinsic slope values. The chorogram may be used for slope data expressed areally, but ordinarily the values must be read from a scale, the effectiveness of which decreases as the number of different values increases. It presents visual difficulties if combined with much other data. The point, as a graduated dot, was used by Eckert as essentially a discontinuous Lehmann hachure. It provides better (smoother) shading, but it is impossible to read precise values therefrom.

is subdivided into small squares (1/100 square mile) and the average slope of each square is estimated. Then, using one dot for each degree of average slope, the dots are placed within each square in such a manner as to create, to a reasonable degree, the effect which might be produced by a halftone of a zenith-lighted model of the area.[7] Obviously the system of presentation can be no more accurate than the method of determining the average slope of each square. Field survey by traverse would probably be the most precise, but it is likely that the modern *Multiplex* technique would lend itself to the running of similar traverses in the laboratory. Since the aim was in the direction of relief presentation rather than in methods for ascertaining average slope, the procedure used, until tested, may properly be termed an expedient. Mr. James A. Barnes suggested this method, and it should be noted that no one realizes better than he its limitations.[8]

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[7] The area selected for experimentation is the major portion of the south central five-minute quadrangle of the U.S.G.S. Roxabell sheet, an area in Ross County, Ohio. It was chosen for its variety of slopes. Among other landforms a river bluff, flat-topped hills, rounded hills, and a riverine terrace occur. This portion of the topographic map was enlarged photostatically to approximately nine times the original area. Horizontal and vertical lines spaced every tenth of a mile were drawn on the photostat. The average slope of each square was ascertained and the values were plotted on the base of the map-to-be on which a like grid had been constructed. The position of the dots in each square was determined by reference to the enlarged topographic map. The dots were placed so that they provide continuity with the dots in the adjacent squares.

[8] Mr. Barnes, then pursuing graduate work in the Department of Geography at the University of Wisconsin, in response to a request from the author, replied as follows: "A simple but somewhat inaccurate method (of determining average slope within a small area from a contour map) would seem to be that of counting the number of contour lines within each square of 6.4 acres. If all contour lines were straight lines the least possible slope in any square would exist when the contour lines were diagonal to the sides of the square. The tangent of the angle of slope would equal $\frac{nC}{528\sqrt{2}}$, when n represents the number of contour lines and C the contour interval in feet. Similarly, the greatest slope would exist when the contours were parallel to either pair of sides. In this case the tangent of the angle of slope would equal $\frac{nC}{528}$. Theoretically the average slope would be somewhere between, and for purposes of practicality the formula $\frac{\frac{nC}{528\sqrt{2}}+\frac{nC}{528}}{2}$ can be used. In its simplest form this reads: Tangent of the angle of slope = 0.00162 nC.

"But the angle of slope as determined assumes that all contour lines are straight lines, a situation relatively rare in the area chosen. If x represents the ratio between the actual angle of slope and the angle of slope derived by the above formula, then the true angle (average) of slope may be assumed to be x times the angle which has the tangent 0.00162 nC."

Mr. Barnes suggested using the Wentworth formula as an element of x. The average slope for the area was ascertained by the Wentworth system (7.3°) and this was used as the numerator of the ratio x, the denominator being determined as the average of the area (5.826°) according to the above formula (without x). A table was prepared, and it was a simple matter to count the number of contours in a square and thereby determine the number of dots which should be placed in that square.

Assuming the slope data to be correct, the resulting effect is far from ideal. In addition to its relative coarseness (more and smaller dots of less value would create smoother shading), the experimental product suggests difficulties both technical and practical. Perhaps the less important is the technical problem of producing precise values (of dark and light) by dots. When uniform-size dots are used and their number is varied directly with slope regardless of any ratio between the area of the dot and the square) the resulting values are not strictly accurate, since the amount of light reflected from a slope to an observer located at the light source (the zenith) varies with the cosine of the angle of slope.[9] This difficulty presumably could be overcome by varying the area of the dots to bring the ratio of black to white into the correct proportion, which Eckert did in his Punktsystem. This does not, however, satisfy all the requirements if we are interested in producing values of shading which are visually proportional to one another according to slope angle. If the ratio of black to white were varied as the cosine of the angle of slope the resulting visual effect would remain incorrect, since, as is well known in halftone lithography, if dot area be increased (or decreased) uniformly the consequent values will not vary in the same ratio.[10]

The other and, to the geographer, the more important question is: can such a system be combined with a standard topographic map in such a way as to enhance the map's realistic portrayal of landforms and yet provide usable slope data? The experimental map is divided into many small, essentially useless squares and is consequently relatively cluttered. This confusion would be greatly increased if it were combined with the other printings of a topographic map. It would seem to be feasible, providing care were taken in the placing of the dots, to drop out the grid in printing and indicate it only by hatching along the neat line. Since the dots are placed so far as possible where the slope actually occurs, it would seem that any unit area (6.4 acres, in this case) wherever chosen would yield nearly correct average slope information. The reader could simply prepare, or be provided with, a mask showing units of area which he could place over any section of the map, count the dots, and thus estimate the slope.

If the dots were printed in a hue of an intensity which lends itself to blending by the eye, such as mauve, the shading might still be effective and yet allow the dots to be counted readily for purposes of research. The printing of the dots would likely be an overprint, and such a plate could be run separately, or with the culture and hydrography in colors of less density, which would allow the dots to be visible. Other combinations would be technically feasible.

[9] ECKERT: op. cit., p. 579.

[10] This complicated relationship is well summarized in *The Relation between Dot Area, Dot Density, and Tone Value for Halftone Images,* Technical Bulletin No. 5, Lithographic Technical Foundation, Inc., New York, 1945.

Meeting of Map Division, ICAO

THE fourth session of the Map Division of the International Civil Aviation Organization was held at Brussels, Belgium, March 8, 1948, with 26 states and 2 international organizations participating. Sixteen plenary meetings were held, in the course of which eight subcommittees were appointed.

Outstanding among achievements of the Division was the unanimous agreement to accept the new projection system for the World Aeronautical Chart ICAO 1:1,000,000, advocated by the United States Delegation. The system previously specified for this world series had been found unacceptable by a number of the member States.

Under the new system, each tier of charts between the Equator and 80° latitude, all of which measure 4° in latitude, will be constructed on its own parallels of the Lambert conformal conic projection. Polar areas will be plotted as before on the stereographic polar projection. Thus, under the new system, there will be 42 separate projection bands (21 in each hemisphere) compared to 10 in the old. The chief advantages of the new system are that scale errors will be considerably smaller, in no case exceeding half of 1 percent on any one chart; assembly of sheets will be easier, and the series can be used equally well for national topographic series.

The layout of the World Aeronautical Chart was based originally on that of the 1:1,000,000 world series produced by the United States, and the numbering of the sheets of the two series was identical. However, because the ICAO series layout has gradually been changing to meet requirements of individual states, the numbering has been changed to fit the new layout. The Division recommended that 2,000 be added to the ICAO sheets numbers to distinguish them from the U. S. sheets.

Definite proposals for the international distribution of aeronautical charts were put forward. The delegates considered at length the problems and difficulties of co-ordinating distribution of the 1:1,000,000 charts on an international basis, recommending that for the immediate present the states involved send to all other Contracting States the particulars of their aeronautical charts and the departments or agencies from which they may be purchased, these particulars to cover all charts produced to ICAO specifications and all charts falling within the general categories recommended by the Map Division for international air navigation. Later, the distribution would be carried out through an ICAO regional organization.

It also was recommended that states should establish aeronautical information services for the production and distribution of national basic documents containing aeronautical information. Tentative recommendations were made regarding the content and format of the basic documents required to meet all air navigation requirements.

The Division also recommended that coordination of aeronautical information services should be the responsibility either of a new division of the Air Navigation Committee or of the most appropriate existing division functioning as necessary on a regional basis.

It was also agreed that the layout of sheet lines for Radio Facility Charts normally should be on a national basis, except that in areas composed of a

number of neighboring States the layouts be determined by agreement between those States.

Among other recommendations was one to accept the previously formulated specifications for the ICAO 1:500,000 aeronautical chart series of Europe.

Among the other matters considered but on which no definite action was taken, were: Development of the oblique Mercator projection in connection with Long Range Route Charts; sheet layouts for Plotting Chart series at the scale of 1:3,000,000; the problem of characteristics of existing charts of electronic aids to navigation comprising Consol, Gee, Loran, Omni-directional Range, and Airborne Radar scanning equipment; and the production of chart types showing danger areas.

* * *

Radar's "Magic Eye" Surveys a Continent

SURVEY BY RADAR of Australia's 3,000,000 square miles of territory is now being undertaken in reorganizing the mapping of that continent under its National Mapping Council. Consisting of the commonwealth's Surveyor-General, an army representative and the surveyors-general of the commonwealth's six states, the Council has assigned the task to the Australian Army Survey Corps and the Royal Australian Air Force survey unit. The continent will be systematically mapped for settlement, regional planning, highways, railways, water supply, mining, forestry, agriculture and irrigation, and all defense service needs will be coordinated.

Officers from the Australian Army and Air Force are in England studying recent advances in radar map technique, developed largely in Southeast Asia during the war, while a special committee of physicists attached to the Council for Scientific and Industrial Research is engaged in research to perfect Australian equipment and investigate factors in Radar use peculiar to Australia. Settled areas will be mapped on a scale of 1 mile to the inch and the hinterland at 4 miles to the inch.

Colonized less than 160 years ago, Australia is largely unmapped in the technical sense. Maps of one kind or another cover the whole continent—some of 8 miles to the inch—but many are based on old and questionable data. Only part of the country, embracing a relatively narrow coastal strip, running roughly from Adelaide through Melbourne and Sidney to Brisbane, has been covered by first-class surveys.

Areas to be charted include the lonely barren center of the continent, the remote north and northwest, and the jungle-clad fastness of the Australian mandated islands where field parties would be costly and difficult to maintain. Equipped for a protracted stay, the scientific expedition arriving in the Antarctic toward the end of 1947 will also use Radar technique in exploring and mapping the icebound wastes of Australia's possessions in that region.

Adaptation to surveys of Radar's "magic eye" is revolutionizing the mapping of great expanses of country, making possible immediate measurement of long distances over which Radar waves speed at a rate of 200,000 miles per second, compared to months required to cover such distances in difficult terrain by ordinary survey. With the survey party 150 miles away, camera location is determined by remote control at the moment of exposure within an accuracy of 20 yards. Camera tilt effect on the photograph is measured by photogrammetric equipment and all points of detail are transferred to the conventional map in their true positions.

By these modern methods a complete and accurate map of the Australian continent is possible within the next 20 years.—*Civil Engineering*, February 1948.

The Society's Cartographic Section

By RICHARD U. LIGHT

PRESIDENT, AMERICAN GEOGRAPHICAL SOCIETY

THE publication by the American Geographical Society in 1945 of the 107th sheet ended the intensive effort connected with its Millionth Map of Hispanic America. That the work on this map cannot ever come to a full stop is evident from the need already arisen for revision of the sheets—a task begun, as a matter of fact, 4 years before the final sheet was published.

An important opportunity, however, now arises: to set the pattern of what shall be done with one of the Society's most valuable assets, the team of editors, compilers, and draftsmen that produced, and in turn was educated by, the Millionth Map. The value of this group cannot be measured by size alone —seven men, or sometimes eight, make up our cartographic section—but lies in talent and the discipline of long association with a task, rather than in the echelons of organization. We may illustrate the point by glancing at the development of the World Millionth Map, and particularly at the share of its success the Society may claim. It should be recalled that the idea of an International Map was discussed through five Congresses of the International Geographical Union between 1891 and 1908, and also at a special convention held in 1909, before the first sheet made its appearance in 1911. When the Society entered the ring in 1920, only 16 of the standard sheets of the projected map had been completed. We then independently undertook to do the Latin-American republics, nearly one-sixth of the world's land surface. In 1938, when the Central Bureau issued its last published report, the 70 sheets we had produced constituted nearly 35 percent of the standard sheets listed. No better example could be cited to show the ability of an independent institution to engage steadfastly in a creative task. It is almost anticlimactic to add that, to the Society, the Millionth Map was but part of its broad program of research in Hispanic American geography.

Millionth sheets issued after Pearl Harbor were restricted from public distribution for the duration. The entire series became a basic source for the construction of the millionth-scale aeronautical charts of the United States Army Air Forces. In this task, members of the staff co-operated so far as possible in furnishing new compilation material where revision was needed. Several years before, the Society had begun work on a reduction of the millionth sheets to a smaller scale. At the request of the State Department (Co-ordinator of Inter-American Affairs), our map-making crew completed this project in the form of a general reference map of the whole of Latin America in three sheets on a projection that itself is an ingenious addition to the map makers' technical inventions. This series, known as the Map of the Americas, 1:5,000,000, was available to the public throughout the war and served also as a basis for the aeronautical planning charts so useful to the Army's movement of long-range aircraft.

The Map of the Americas on the scale of 1:5,000,000 proved popular with the public of both continents, and completion of the two remaining sheets, covering

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the rest of the Americas, including the Arctic, was therefore undertaken. This was partly under the sponsorship of the Army Map Service, a further indication of the worth of the project. Nothing like this series has ever before been produced for public distribution, and it affords great satisfaction to announce here that the drawings for the new sheets were completed in December 1947, and are expected to be available in published form this spring.

Yet another new and original map is off the press, prepared at the request of the State Department. Working characteristically in the pattern attempted in all its publications, the Society has done that "which is not done, or is not likely to be done, by other institutions and agencies" to design and produce a new cartographic representation of the world. This map has several distinctive features. In the first place, it is large, almost as large as Mr. Hoen's presses can produce. Second, it is on a cylindrical projection that is a modification of the Mercator; areal distortion in high latitudes is reduced, but the simplicity of straight-line meridians and parallels and the east and west continuity are retained. In addition, on the back of each sheet is a nomograph that enables great-circle courses and distances to be plotted and measured with ease. Third, beneath an apparent simplicity lies a wealth of critically examined detail freshly compiled from the best and most reliable sources. Finally, without sacrifice of content, it is one of the most decorative wall objects to pass through our hands.

Several broad conclusions may be drawn from the accomplishments recited above, and it is well that we pause to reflect carefully on what they mean. It is extremely doubtful whether these studies could have been developed within any department of government because of the special handicaps under which government agencies must normally work. The moment that a government steps beyond the province of its own political area, its activities become suspect. The collection, however, of the data on which to construct accurate, informative maps must be done in an atmosphere of confidence. Confidence was the core of the Millionth Map, the confidence that led competing oil companies to submit private information, the confidence that persuaded several Latin-American republics to permit the use of unpublished material from their confidential archives, and the unique confidence that made of the published sheets or the compilations the cartographic base for studies and negotiations in connection with the settlement of the major boundary disputes.

Nor is it likely that the geography department of a university could have undertaken these tasks. For only by the development of a new theory of university departments, imparting to them stability of finances and personnel, independence from the protean calls of academic duties, and relief from teaching, could such continuous, unrelenting effort be maintained.

In an age when institutions are faced with economic extinction, their very right of survival in dispute, the quiet warning of what would be lost by the disappearance of such unique forces as this little body of map makers should be received with the utmost seriousness. It is all too easy to destroy, whether by direction or neglect. The rebuilding is another matter.

CONGRESS NEWS

Secretary's Report

(As Presented at Eighth Annual Meeting, June 21–23, 1948)

The period between the Seventh and the Eighth Annual Meetings has been one of reorganization under the new Constitution—one of trial, tribulation, and work for the officers—a year spent in tooling up. I am glad that the Congress has a loyal membership nucleus to weather such years when it is more necessary to give than to receive. We thank those members for that support which is our morale and our *esprit de corps.*

As compared with last year's net growth in membership of 250 members, this year, unless a vigorous drive is started for new members to offset resignations and the normal expectancy of delinquents for 1948, we stand to show a slight drop rather than growth in membership for the year.

The psychological impact of increased dues and decreased publications can well be assumed to be a large factor in current delinquencies, a few resignations, and a lull in new-member activity. This may be the case where one joins the Congress primarily to get the Journal, stressing perhaps the importance of joining an organization to be a part of it rather than virtually a subscriber to a magazine, stressing the importance of being a voice in the professional activities of surveying and mapping, as well as a reader of the best survey journal, your own SURVEYING AND MAPPING.

Vigorous action by your new Publications Committee and the Editor has been taken to step up publications.

Let me give you a few statistics on the membership. The current total mailing list is 1500 in round numbers, which includes some 200 members delinquent for 1947, and 140 library or institutional members. Thus the active 1948 individual member list amounts to 1160, of which some 800 have paid their dues to date.

I would like to mention that a lot of our delinquents are surveyors in the field whose mail does not catch up with them. They are busy and the bills stay in the "In" boxes and get covered up. They are not really out of the Congress. They are just not paid up.

I might say here that, if every one of you assumes the responsibility of being a member at large of the Membership Committee and talks up the spirit so evident at the Annual Meeting, I think it will go a long way toward getting new members. In the case of those borderline members who cannot quite make up their minds whether to stay in or drop out, I think it is just that little thing that does the trick. Talk it up.

Now to some of those boresome details, so important, but very uninteresting to listeners.

(The Secretary then read a few abstracts and highlights from the minutes of the six Executive Meetings held during the year.)

WALTER S. DIX,
Secretary

Financial Statement

(As of June 30, 1948)

INCOME

Balance on hand (July 1, 1947)	$ 1,784.23
Memberships (Sustaining)	325.00
Memberships (Libraries)	497.41
Memberships (Individual for 1947)	853.08
Memberships (Individual for 1948)	4,128.02
Sales of back issues	56.72
Miscellaneous sales of publications	38.93
Seventh Annual Meeting (exhibit space, dinners, registrations)	2,708.65
Sale of Congress emblems	98.75
Dues of Washington Local Section (in trust)	52.00
Eighth Annual Meeting	3,392.50
TOTAL ACCOUNTABLE FUNDS	$13,935.29

EXPENDITURES

Printing—SURVEYING AND MAPPING (July–Dec., 1947 issue)	$ 1,646.48
Printing by lithography (The Panel discussions)	338.75
Miscellaneous printing	595.46
Mailing service	550.08
Office supplies	313.75
Addressographing and Typing	251.11
Seventh Annual Meeting (charges in Hotel)	1,695.80
Messenger service, Banking, P. O. box rent, Travel, Telephone	75.66
Prizes for articles and Honorarium	250.00
Eighth Annual Meeting (charges in Hotel)	2,554.40
TOTAL EXPENDITURES	$ 8,271.49
Bank balance on July 1, 1948	5,663.80
TOTAL ACCOUNTED FUNDS	$13,935.29

GENERAL BALANCE

Bank balance on July 1, 1948	$ 5,663.80
Accounts receivable: Sale of emblems	137.59
Current dues	750.00
New members	400.00
Eighth Annual Meeting	200.00
TOTAL ASSETS	$ 7,151.39
Unpaid Obligations	0.00
NET VALUATION OF CONGRESS	$ 7,151.39

Respectfully submitted,

RICHARD T. EVANS,
Treasurer.

Editor's Report

(As Presented at Eighth Annual Meeting, June 21–23, 1948)

At the last Annual Meeting, I reported that two factors would determine the regularity and the frequency with which the Journal would be issued. One was a distribution of the work-load; the other was building-up a continuous back-log of articles ready for publication. It was becoming increasingly clear towards the close of 1947, that unless some drastic action was taken to achieve both of these objectives no relief could be expected in our publication schedule.

Accordingly, under the direction of President Wright, a Publications Committee was organized with Mr. Helmuth Bay as chairman. The uniqueness of this Committee lay in the fact that it was to be a working committee and appointment to it was made dependent upon agreement to undertake specific obligations. The Committee is representative of both federal and non-federal groups. Each committee member is a specialist in his field, which insures contributors a constructive appraisal of papers submitted for publication.

From the standpoint of the Journal, the organization and activation of this Committee, was, in my opinion, the greatest single contribution made during the past year.

Intimately bound up with the Publications Committee was the development of a backlog of publication material. The importance of this is understandable when it is realized that in a single normal quarterly issue of the Journal 16 to 20 major articles are included. It is therefore necessary to have at least that number, and preferably twice that number, in our files at all times if we are to maintain a regular publication schedule. I am happy to report that considerable progress has been made toward this end. Our position today is very favorable, in comparison with a year ago. The complete manuscript for the Jan.–March issue, which comprises the Membership Roster, an Index, and the Revised Constitution, is in the hands of the printer. In addition, 18 articles, of which 13 are original papers and 5 reprints, are also at the printers. Besides these there are approximately 10 papers in my hands that have passed through the screening process of the Publications Committee and are now awaiting a final edit before being sent to the printer.

But while our position is favorable, it may be some time before its full effect is felt. This is due to circumstances somewhat beyond our control. We are still working under the handicap of the cumulated lag that developed over the past 2 years, so that our publisher has not yet become responsive to our accelerated tempo. Until this slack is taken up, we can expect delays and it may even be necessary to run a combined issue during this year.

The prospect for the immediate future is about as follows: The Jan.–March issue should be off the press and ready for distribution within a month. This will be followed closely by the April–June issue, which will be a normal quarterly number.

The outlook for 1949, however, is good. We are beginning to receive material from several sources, one of the most fruitful being the Joint National Societies Committee. The Chairman of this Committee, Prof. Harding, receives copies of papers presented at the various State surveying conferences, and he in turn forwards them to the Congress for consideration. Another source will, of course,

be the papers presented at this Meeting, many of which will no doubt find their way into the Journal. In addition, a number of papers may be expected from individuals. So that while we are still not out of the woods, we are beginning to see the light.

There is one further thought that I would like to project with regard to our Journal. I think we all agree on the desirability of publishing regularly four issues a year. There can be very little argument about that. On the *kind* of issues, however, that should be published, there is room for a reasonable difference of opinion. It is my firm belief that we should not sacrifice quality in our Journal for the sake of expediency, no matter how urgent the need might appear. If circumstances should arise that would prevent frequent continuous contact with our membership through the medium of the Journal, then some other means should be found for maintaining that contact. We have built up an enviable reputation for the Journal. Once lost it would be difficult to retrieve.

In conclusion, I would like to express my thanks to Helmuth Bay, the Chairman of the Publications Committee, and to the members of his committee, for their cooperation in the preliminary edit and preparation of material for the Journal.

A. L. SHALOWITZ,
Editor-in-Chief

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Reports of Technical Divisions

(As Presented at Eighth Annual Meeting, June 21–23, 1948)

PROPERTY SURVEYS DIVISION

Two principal activities of the Division were the distribution and promotion of use of the Technical Standards for Property Surveys, and the further development of a report on surveying fees.

Through the efforts of the Secretary of the Congress, Walter Dix, and the Division, most of the supply of reprints of the Standards has been distributed to individuals and organizations throughout the country. I think there are 2000 in the original printing. An additional four or five hundred reprints made by the Cleveland Society of Professional Engineers have also been widely distributed. The Division is debating the advisability of reprinting the Standards to be contained in a single letter-size sheet in a form suitable for enclosure with proposals, estimates, and other communications relative to property surveying. Experience has proved that such a procedure worked very favorably so far as the client was concerned.

The study of surveying fees has reached the stage of a document which has had its first review by the Executive Committee of the Division. This document has undergone certain changes in an attempt to meet opinions and questions raised by the Committee. It has further been changed, on legal advice, to conform to the attitude of the Department of Justice as expressed in its current suit against the Washington Real Estate Board. I might say that the criminal suit filed has been ended with a determination against the Government's position. The civil suit has yet to be determined. In any event, it was felt by the Executive Com-

mittee and by the legal advice requested that it still would be preferable for an organization of this sort to abide by the strictest determination of legal propriety as indicated by the attitude of the Department of Justice.

It is probable that a final recommendation will be in a form quite similar to that of the current document, since the diverse opinions that have been expressed by the Executive Committee were principally questions of interpretation and phraseology. It is hoped that the completed "Recommendations on the Determination of Proper Fees for Property Surveys" will be forthcoming within the next few months. It is hoped that this document will be printed in sufficient numbers and in a form suitable for wide distribution. This document should become an important addition to the "Standards of Practice" previously adopted by this Congress.

At the Property Surveys Division Meeting in June we lived up to our reputation to date of being very young and possibly very foolish. We attempted two very difficult jobs in the life of the Property Surveys Division. One was the study of the question of standard practices, which we, fortunately, have completed, and I think completed well. It was a very difficult job, something that has never been attempted. That project on a standard practice to cover surveying procedure on a national scale has been completed.

We then tackled a far tougher job, the recommendation on fees. I think we have that in hand. I think we will be along with a report that the Congress will feel is on a par with our previous one.

At the Meeting we took on another one, even worse. As long felt, and as expressed in the foreword to the "Standards of Practice," one of the things our profession needs very badly is a single textbook for practicing property surveyors. We have lots of textbooks, but we have none directed at the practicing property surveyor. We have launched ourselves on a new program. We have found for ourselves a very aggressive, very ambitious, possibly a foolish, but a very ardent new member, who says he will tackle the job, Mr. John P. Goggin, of Clare, Michigan, who is chairman of a committee with the duty to develop a Table of Contents. We are limiting ourselves to a Table of Contents at the present moment for a projected book or handbook for the use of property surveyors. We are going to get started on that very shortly.

Mr. Goggin will welcome any and all suggestions as to what that book should contain. I say only a very young organization would tackle such a tough assignment, but I hope we can do something about it.

Your Chairman has appeared before the New Jersey State Conference on Surveying to discuss the adopted Standards. He has appeared also, with Program Chairman G. Brooks Earnest, before the Illinois State Conference on Surveying, and is at present working with Professor Earnest and Professor Harding to plan the Ohio State Conference this fall.

Your Chairman is pleased to announce the successful beginning of a course at Purdue University in Property Surveying, under the direction of Instructor W. E. Camp, which course the Division helped in a slight manner in formulating. The Division has been requested to furnish information for a similar course also at Warren H. Wilson College at Swannanoa, North Carolina. It is the expressed belief of this Division that the profession has much to gain by stimulating such courses in our engineering schools.

Your Chairman wishes to thank his Committee Chairmen, the several new,

enthusiastic members who have become active during the past year, and the Officers of the Congress for their support and assistance, with particular reference to the enthusiastic help that Secretary Dix has given the Division during 1947 and 1948.

S. A. BAUER,
Chairman

CONTROL SURVEYS DIVISION

The responsibility of the Division is to answer any inquiries that may be referred to it by the Congress and also to keep the membership advised of current activities in control surveys. During the past year there has been one inquiry addressed to the Congress relative to the relation between various datum planes for vertical control, particularly in the Middle West. That inquiry received consideration by the Division; a reply was made; and I hope that we may have something published in SURVEYING AND MAPPING on that subject.

The current activities in geodetic surveys are primarily those of the Coast and Geodetic Survey. Most of our work at the present time is in connection with flood control, particularly in the Missouri River Valley. We are also working extensively in Alaska.

I was interested in Mr. Pitkin's address Monday morning in which he stressed one of the recommendations of his committee of national and state planning boards that there should be cooperation between those organizations that are interested in control surveys. We, in the Coast and Geodetic Survey, are in contact with mapping and engineering organizations who need basic Federal survey control. We are in contact with the U. S. Geological Survey, the Forest Service, the Corps of Engineers, the Bureau of Reclamation, state planning boards and municipal organizations. We base our program for control surveys on information received from such organizations. Our work load at the present time is about three times that which we can accomplish with the funds that are available.

There have been two publications concerned with control surveys recently issued by the Coast and Geodetic Survey. One is Special Publication No. 237, "Manual of Geodetic Astronomy" and the other, Special Publication No. 239, "Manual of Geodetic Leveling." They may be obtained from the Government Printing Office at a nominal price.

At the present time we have in course of preparation at the Government Printing Office a publication, "Definition of Terms Used in Geodetic and Other Surveys", and a publication of "Tables for Computation of Geographic Positions by Natural Functions." These should be available sometime late this year.

The Division has watched the developments in electronic surveying very closely, particularly from the viewpoint of bringing to the attention of the Congress any instrumental equipment which would be feasible for ordinary surveying use. Research and development is being done by the national defense organizations on electronic survey methods. Much of that is confidential. We hope that eventually there will be developed a small portable instrument, electronic in character, by means of which we will determine distances with the requisite accuracy and also, perhaps be able to make angular determinations.

Experiments are underway and we expect to keep the Congress advised of any developments which would be particularly advantageous to the local surveyor engaged in ordinary survey practice.

H. W. HEMPLE
Chairman

CARTOGRAPHY DIVISION

As no meetings or programs were sponsored by the Division during the past year, and as your present speaker has not had the opportunity to examine the detailed minutes of the last meeting, this report must of necessity be a summary or review of that meeting.

The Technical Division on Cartography met as scheduled, on Monday afternoon, June 21st, with approximately 68 persons in attendance.

The meeting was opened by President Wright, who called attention to the relative inactivity of the Division on Cartography for the past 2 years, and requested the group assembled to give consideration to the reorganization of the Division.

As the chairmanship of the Division was vacant, President Wright had previously appointed a temporary Committee to conduct the meeting, and to sit as a panel and lead the discussion. This Committee consisted of the following temporary members:

W. C. Crump, Hydrographic Office, *Chairman*
G. B. Littlepage, U. S. Coast and Geodetic Survey
R. Voskuil
C. H. Davey, U. S. Geological Survey
E. M. Rowell (Miss), Army Map Service
C. E. Riddiford, National Geographic Society
L. Blum, Aeronautical Chart Service

The last two members mentioned, although invited to participate in the meeting, were unable to attend.

Each of the Committee members had also been previously requested to prepare for presentation their ideas on the advisability of reorganizing; advantages to be gained; advantages of having a journal already established in which to circulate ideas; and the desirability of forming an independent group, or continuing under the sponsorship of the Congress.

All Committee members were requested to speak. That they had given considerable and careful thought to the problems under discussion was plainly in evidence. They are to be thanked and congratulated for their excellent presentations.

The meeting was then thrown open for questions, comments, and suggestions from the floor. Those offered were valuable and constructive, and showed beyond any reasonable doubt that this Division should not only be reorganized, but that its duties and programs could easily exceed those previously considered.

A request of the chairman for a showing of hands on the desire to reorganize resulted in a unanimous ballot of those members voting.

The members present were then requested to offer or discuss their ideas relative to the activities for the coming year. Again the suggestions offered indi-

cated that the members had also given careful thought to the number and types of programs desired, and to the desirability and means for an interchange of map making, compilation, and reproduction techniques between mapping activities.

The chairman then requested nominations for a permanent chairman and Committee to serve for the ensuing year. The incumbent temporary Committee was elected to continue in its present capacity.

The members were then requested to offer any additional suggestions or comments. It was the consensus of opinion that the meeting had been highly successful and had accomplished its original purpose.

The chairman expressed his thanks and appreciation to the Committee members for their assistance in making the meeting a success, and to the other members present for their attendance and valued suggestions.

I would like once more to thank the Committee members, and those members who participated in the discussion from the floor, for it was they who spearheaded the meeting, led the discussions and are, therefore, responsible for its success.

W. C. CRUMP
Chairman

* * *

Resolutions Adopted at Eighth Annual Meeting

The following Resolutions were unanimously adopted by the Congress at the Eighth Annual Meeting, June 21–23, 1948.

RESOLUTION ON STATE MAP REQUIREMENTS

WHEREAS, The Executive Office of the President, through the Bureau of the Budget and the Congressional Appropriations Committees, during the past few years have recommended and approved a substantial increase of public funds for the implementation of a national mapping program, and

WHEREAS, The Federal Government's principal mapping agencies, the Geological Survey and the Coast and Geodetic Survey, have trained and equipped efficient organizations to carry out this program, and

WHEREAS, Approved projects for reclamation, mineral resource investigations, highway construction programs, and flood-control projects will require within the next 20 years the expenditures of billions of dollars of public funds, and

WHEREAS, The basic data supplied by accurate topographic maps should be provided in advance of the planning and carrying out of these projects, be it therefore

RESOLVED, That the American Congress on Surveying and Mapping by appropriate correspondence urge the various state planning and development agencies throughout the nation to study the map requirements of their respective states and assist the Federal agencies in determining and implementing a long-range program to meet these needs for surveys and maps.

RESOLUTION ON COMPETITIVE BIDDING FOR PROPERTY SURVEYS

WHEREAS, It is the policy of the Veterans Administration to let contracts for professional services in connection with property surveys on the basis of competitive bidding, the primary consideration being price, and

WHEREAS, Competitive bidding for professional services has long been considered an unsatisfactory method for obtaining property surveys, and because reputable qualified practitioners do not offer their services on such a basis, and

WHEREAS, No specifications have been or can be developed that will properly equate men on the basis of professional ability, knowledge, and understanding, therefore be it

RESOLVED, That the American Congress on Surveying and Mapping declare competitive bidding for professional services in connection with property surveys incompatible with professional practices and economical results and not conducive to obtaining best results, and be it further

RESOLVED, That the American Congress on Surveying and Mapping make presentations to the Veterans Administration stating its attitude toward competitive bidding and request that in the future such contracts by the Veterans Administration be let on the basis of professional responsibility and ability through individual negotiation with qualified surveyors or engineers.

RESOLUTION ON EIGHTH ANNUAL MEETING

WHEREAS, The Eighth Annual Meeting of the American Congress on Surveying and Mapping presently assembled, having reached the final day of its sessions, all of which have been most interesting and successful, it is resolved that the appreciation of this Congress be expressed to all of those individuals who by their contributions of time, effort, and funds have made this year's successful meeting possible.

We gratefully express our appreciation to each of our speakers, discussion panel chairmen and panel members, the chairman and members of the Program Committee, and instrument exhibitors.

May we acknowledge our pleasure and appreciation to those residents of the Americas who have honored us by their presence at our sessions.

NEW MEMBERS

BASS, LEO, Photogrammetrist, 5-B Parkway Rd., Greenbelt, Md.

BRIERLY, WILLIAM B., Geographer, 4105 Wisconsin Ave., N. W., Washington 16, D. C.

BRODNAX, EDWIN P., Cartographer, 2456 20th St., N. W., Washington 9, D. C.

BUSH, HAROLD L., Civil Engineer and Surveyor, 544 Willard Ave., S. W., Atlanta, Ga.

CHAPMAN, CHARLES V., JR., Instructor, Civil Engineering, University of Maine, Orono, Maine

CROCKETT, VERNON P., Engineer and Surveyor, State National Bank Bldg., Sheffield, Ala.

DELANEY, MAURICE S. A., Cartographer, 8400 Hartford Ave., Silver Spring, Md.

FARR, W. L., Land Surveyor, Greensboro Road, Thomson 1, Ga.

GORDON, AUSTIN R., Cartographic Engineer, Sleepy Hollow Rd., R. F. D. #1, Falls Church, Va.

HALLMARK, NELSON T., Photogrammetric Engineer, 2516 1st Rd., N., Arlington, Va.

HIGBEE, LESTER C., Chief Sales Engineer, W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.

JOHNSON, JAMES, Land Surveyor, City Hall, Midland, Mich.

JOHNSON, W. ALEXANDER, Civil Engineer, 230 Tatnall St., Macon, Ga.

KRICHBAUM, F. D., Civil Engineer and Surveyor, Orrville, Ohio

LANDEN, DAVID, 422 No. Thomas St., Arlington, Va.

LARSEN, HAROLD R., Chief Instrument Engineer, W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.

LE VASSEUR, A. J., Surveyor, Route 2, Sulphur, La.

LEWIS, PAUL J., 311 N. W. 20th Ave., Portland, Ore.

LOPEZ, JOSE EDELMIRO, Topographic Engineer, Avenina Peru y Rio Blanco, Asuncion, Paraguay

McSWAIN, HORACE L., Land Surveyor, R. F. D. #4, Macon, Ga.

MILLER, WILLIAM C., Cartographer, 106 8th St., N. E., Washington 2, D. C.

O'BRIEN, CHARLES V., Cartographer, 935 N. Irving St., Arlington, Va.

OSBORNE, PHILIP J., Surveyor, 3544 Olsen Ave., Portland 2, Ore.

PATTILLO, LEWIS C., Civil Engineer, P. O. Box 348, Hartselle, Ala.

RIEMER, ARTHUR A., 2124 Eye St., N. W., Apt. 701, Washington 7, D. C.

ROBERTS, C. R., Civil Engineer, 1915 Peachtree Rd., Atlanta, Ga.

ROBISON, H. O., Civil Engineer, 1263 Albemarle Ave., N. E., Atlanta 6, Ga.

ROSENBAUM, MARCUS A., Cartographer, 518 Clifton Ter. Apts., N. W., Washington 9, D. C.

SALWIDHAN, PHYA, Maj. Gen., 70 Lang Suan Rd., Ploenchitr, Bangkok, Siam

SENSENAY, HARRY S., U. S. Geological Survey, Room 7220, F.W.A. Bldg., Washington 25, D. C.

SHERMAN, SIDNEY, Research Analyst, 1660 Lanier Pl., N. W., Washington 9, D. C.

SMITH, THOMAS E., Civil Engineer and Surveyor, P. O. Box 224, Pine Lake, Ga.

SUMNER, BILLY T., Civil Engineer, 404 Cotton States Bldg., Nashville 3, Tenn.

THOMSEN, JOHN M., Engineer and Surveyor, 33 Fifth Ave., Berea, Ohio

TROW, STANLEY W., Cartographer, 518 E. 32nd St., Baltimore 13, Md.

WARD, EMILY L. M., Engineering Draftsman, H 277 Alabama Hall, Arlington Farms, Arlington, Va.

WILLIAMS, HAROLD FISH, P. O. Box 1190, Madison 1, Wis.

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